Technical Report No. 32-562

The Ranger 5 Flight Path and Its Determination From Tracking Data

W. L. Sjogren
W. E. Kirhofer
D. L. Cain
W. R. Wollenhaupt
T. W. Hamilton

T. W. Hamilton, Chief
System Analysis

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

December 6, 1963

Prepared Under Contract No. NAS 7-100
National Aeronautics & Space Administration

CONTENTS

CONTENTS (Cont'd)

TABLES

TABLES (Cont'd)

FIGURES

FIGURES (Cont'd)

ABSTRACT

24102

This Report describes the current best estimate of the *Ranger 5* spacecraft flight path and the way in which it was determined. The spacecraft was tracked in the two-way doppler mode until 8 hr after launch, when the batteries were depleted. The transmitter in the rough-landing capsule was tracked for 11 days after launch, except during occultation by the Moon. It is concluded that a small maneuver took place along the Sun-line near the time that power depletion terminated contact with the spacecraft.

A new orbit determination program which treats the effects of station location and physical constant errors was used to estimate the flight path. The results reported on $GM_{\oplus}$ by *Ranger 4* (Ref. 1) are re-evaluated more accurately to confirm the previous results. Author

I. INTRODUCTION

This Report describes the current best estimate of the *Ranger 5* spacecraft flight path and the way it was determined. It very much parallels the *Ranger 4* Report (Ref. 1), except that a more elaborate orbit determination tool was used to obtain the results.

Although a spacecraft failure prevented transponder tracking after launch plus 8 hr, the subsequent tracking of the rough-landing capsule's beacon indicated that *Ranger 5* came within 750 km of the Moon's surface, and then continued on into a heliocentric orbit. Power to operate the two-way doppler system was depleted after 8 hr, and as a result, a complete midcourse maneuver was not executed. The capsule beacon data revealed a small perturbation in the orbit, originally determined by the spacecraft transponder data, which could be explained by the attitude control gas released after the spacecraft failed or by partial execution of the midcourse maneuver.

Section II describes the Deep Space Instrumentation Facility (DSIF) transponder orbit and the orbit determined by occultation of the capsule beacon in terms of its trajectory parameters near the Earth, in translunar flight, and near the Moon. Explanations of symbols used and definitions of key trajectory quantities are given.

Section III summarizes the key events in the tracking of *Ranger 5* and gives a general description of the DSIF stations and tracking modes.

Section IV describes the DSIF transponder orbit determination and displays the effects of physical constants in the solution.

Section V discusses the "midcourse maneuver" situation and the study to determine the cause of the perturbation in occultation time. While the spacecraft batteries were depleted at 8 hr after launch, the beacon carried within the capsule continued to operate on its own power supply and was tracked by the DSIF throughout the mission. Valuable data were taken at Goldstone, DSIF 2, and at Johannesburg, South Africa, DSIF 5, in the several hours prior to and after lunar encounter. Results of these data are presented in Section V.

Section VI gives a functional description of the in-flight determination of the flight path together with a description of the techniques used in editing and weighting the tracking data.

Acknowledgments on the development of the computing programs used in the analysis are also given. The Appendices show the complete printout from the trajectory and the orbit determination programs used to compile this Report.

II. TRAJECTORY DESCRIPTION

A. Launch Phase

The *Ranger* 5 spacecraft was launched at 16:59:07.84 Greenwich Mean Time (GMT) on October 18, 1962, from the Atlantic Missile Range (AMR) using the *Atlas D-Agena B* boost vehicle. After liftoff, the booster rolled to a launch azimuth of 95.6 deg (east of north) and performed a programmed pitch maneuver until booster cutoff. During the *Atlas* sustainer and vernier stages, adjustments in vehicle attitude and engine cutoff times were commanded as required by the ground guidance computer to adjust the altitude and velocity at *Atlas* vernier engine cutoff. After *Atlas-Agena* separation, there was a short coast period prior to the first *Agena* ignition. At a preset value of sensed velocity increase, the *Agena* engine was cut off. At this time both the *Agena* and spacecraft were coasting in a nearly circular parking orbit at an altitude of 188 km and a speed of 7.8 km/sec (space-fixed). After a total coast time of 25.9 min in the parking orbit, the second *Agena* ignition occurred. This parking-orbit coast time was determined after liftoff by the ground guidance computer and transmitted to the *Agena* during the *Atlas* vernier stage. The launch phase was nearly nominal with the exception of the parking-orbit altitude, which was slightly above nominal (approximately 21 km high at second *Agena* ignition; see Fig. 1). A typical sequence of events is shown in Fig. 2.

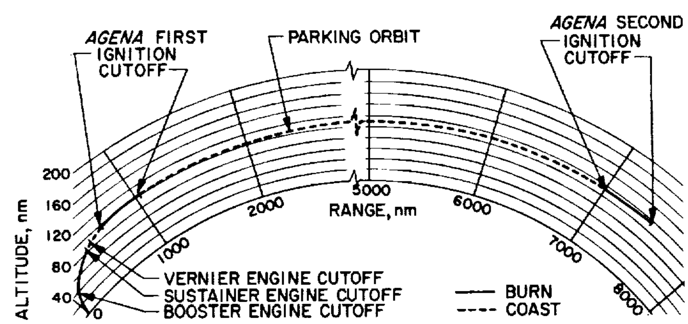

Fig. 1. Ascent trajectory profile

B. Cruise Phase

Injection (*Agena* final cutoff) occurred at 17:34:46 GMT, at which time the *Agena* and spacecraft were traveling at a speed of 10.962 km/sec (space-fixed). The geocentric latitude and longitude of injection were −21.4 and 36.6 deg, respectively, with injection taking place over the eastern coast of South Africa. The *Agena* and spacecraft separated 2½ min after injection occurred. The *Agena* then performed a programmed 180-deg yaw maneuver and ignited its retrorocket. The retrorocket impulse was designed to eliminate interference with the spacecraft operation and reduce the chance of lunar impact by the *Agena*. The geocentric characteristics of the

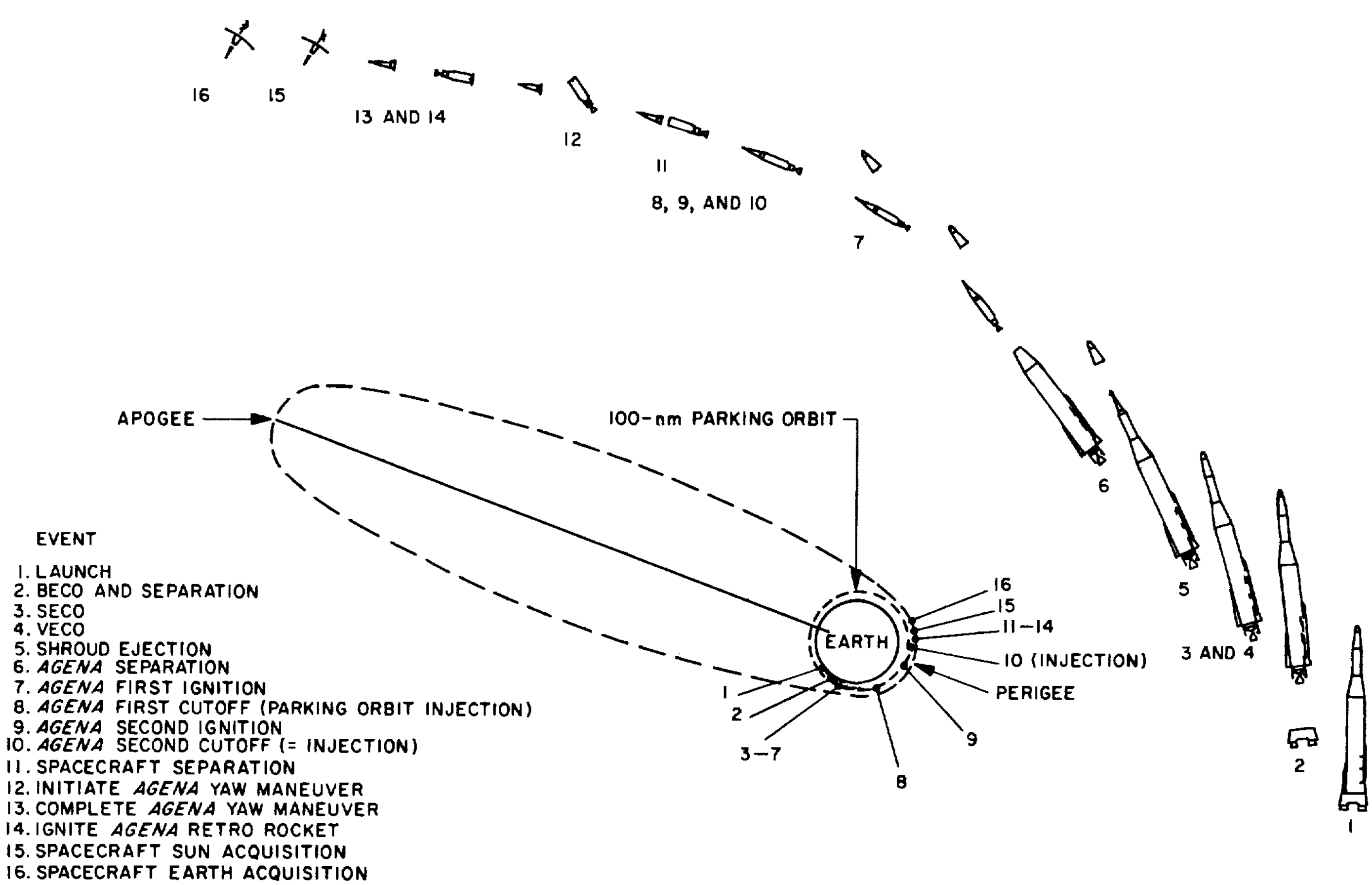

Fig. 2. Sequence of events

Ranger 5 premidcourse orbit are presented in Table 1. (Definitions of the symbols used in Tables 1, 2, and 3 are given in Table 4.)

Within 1 hr after injection, the spacecraft was receding from the Earth in an almost radial direction with decreasing speed. This reduced the geocentric angular rate of the spacecraft (in inertial coordinates) until, at 1.4 hr after injection, the angular rate of the Earth exceeded that of the spacecraft. This caused the Earth track of the spacecraft to reverse its direction from increasing to decreasing Earth longitude (Fig. 3). Note in Fig. 3 where the spacecraft entered the Earth's shadow during the parking orbit and emerged shortly after injection.

The *Ranger 5* premidcourse orbit, as determined using the limited tracking data available, indicated that the spacecraft would miss the Moon by 631 km on the trailing edge, 7.84 deg below the lunar equator. Only 40% of the spacecraft midcourse maneuver capability would have been required to obtain a lunar impact in the target area if the spacecraft had performed properly. However, 40 min past injection a malfunction in the electrical power distribution system made it necessary for the spacecraft to operate from battery power. Because of the relatively short battery life, a nonstandard midcourse maneuver was attempted. The batteries operated within design limits, but were depleted at 8 hr, 15 min past injection during the execution of the midcourse maneuver sequence before any significant maneuver was performed. The midcourse motor burn would have been completed at 8 hr, 21 min past injection.

After the midcourse maneuver attempt, some perturbations due to unbalanced attitude control torques or sources connected with the midcourse rocket system are presumed to have slightly altered the trajectory. Subsequent tracking of the capsule beacon through lunar encounter provided data to determine the postmidcourse orbit. This orbit indicates that the spacecraft missed the Moon's surface by 735 km on the trailing edge, 7.79 deg below the lunar equator. At the time the midcourse maneuver was attempted, the spacecraft was at a distance of

Table 1. *Ranger 5* trajectory characteristics, geocentric

Event	Orbit	Epoch			Central body			Epoch of pericenter passage			Period
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	a	i	ω	Apogee
		r	ϕ	θ	V	γ	σ	e	Ω	ν	Perigee
Injection[a]	Premidcourse	10-18-62	17:37:23.000		Earth			10-18-62	17:34:14.322		25022.369
		5807.2046	−1871.2696	−2891.7849	3.6254794	9.7646336	−2.8587352	283386.38	28.267556	227.09996	6595.0505
		6751.8656	−25.359354	51.068163	10.373187	9.0762677	102.48129	0.97672770	100.32216	17.636897	560177.71
Midcourse[a]	Postmidcourse	10-19-62	01:56:08.000		Earth			10-18-62	17:34:17.998		24359.324
		−50885.925	91512.070	18173.407	−1.6380212	1.6998046	0.70499460	278358.62	28.324781	227.12511	6585.3187
		106273.74	9.8462939	62.976418	7.4244739	18.603799	272.47972	0.97634232	100.29226	154.00054	550131.92
At closest approach to Moon[a]	Postmidcourse	10-21-62	15:53:43.304		Earth						
		−266515.31	267754.70	120687.60	−1.9612389	1.0016943	0.85827348				
		396596.12	17.716569	226.82526	26.960412	4.7987901	270.38492				
After encounter with Moon[b]	Postmidcourse	11-8-62	00:00:00.000		Earth						
		−2285917.5	−594766.98	120984.52	−1.2436209	−0.63197976	−0.05552585				
		2365122.4	2.9321635	147.88414	171.94858	0.45252991	269.95829				
Prior to encounter with Earth[b]	Postmidcourse	8-5-63	00:00:00.000		Earth						
		6441339.0	−202736.00	−1182141.5	−1.5404861	0.23252583	0.17680949				
		6552054.1	−10.394401	45.372136	469.76109	−1.8948481	269.98716				
At closest approach to Earth[b]	Postmidcourse	10-11-63	07:39:44.200		Earth			10-11-63	07:39:44.191		NA[c]
		−45776.424	−1428093.1	−627674.04	−9.4190401	−0.07787804	0.24588253	−900029.1	151.67288	302.04701	NA[c]
		1560615.3	−23.715566	134.0523	105.13094	−0.48371003E-6	270.14636	2.7339608	213.58342	0.25613208E-5	1560615.3
After encounter with Earth[b]	Postmidcourse	12-3-63	00:00:00.000		Earth						
		−4866905.0	−1692771.0	230269.50	−1.1175573	−0.42921603	−0.05969867				
		5158029.1	2.5587015	128.07617	375.71805	0.18188111	269.98275				

[a] See Fig. 4. [b] See Fig. 19. [c] Not applicable

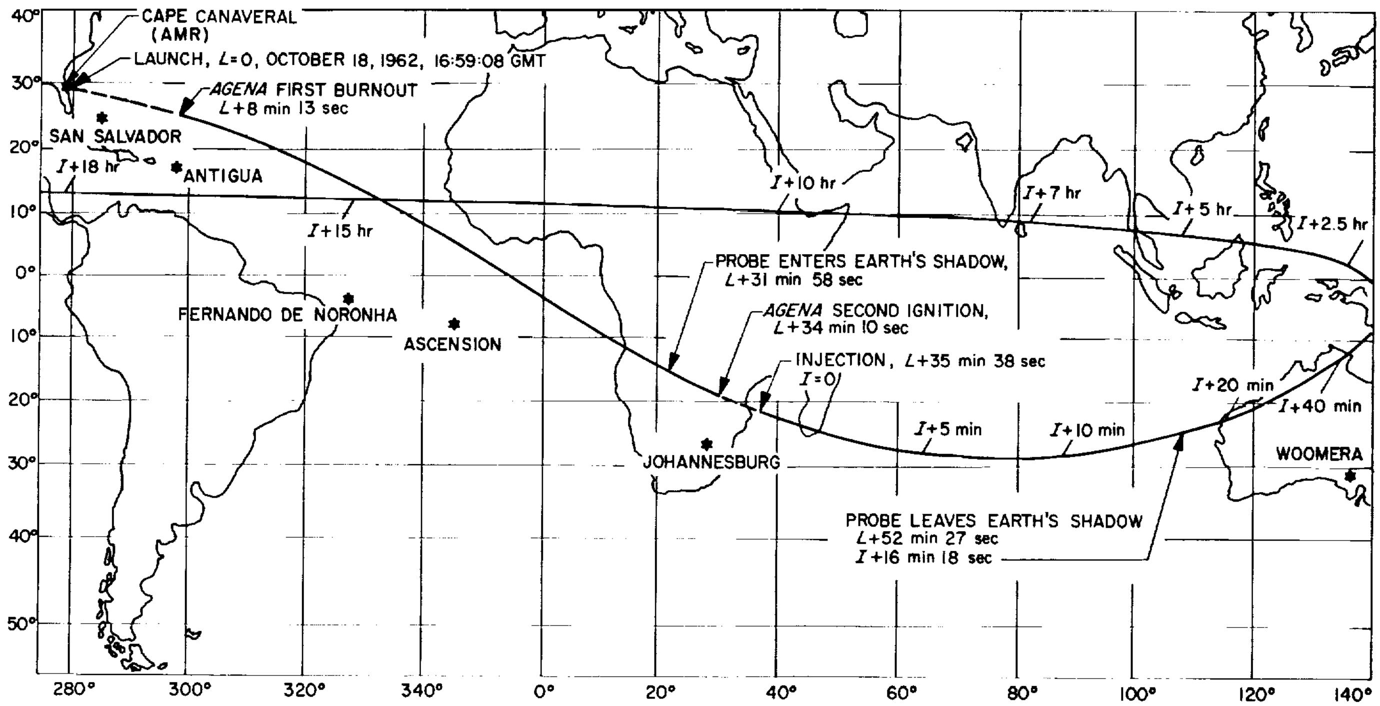

Fig. 3. Earth track of *Ranger 5*

106,000 km and traveling at a speed of 2.46 km/sec relative to the Earth. The spacecraft continued moving primarily under the gravitational influence of the Earth in a highly elliptical geocentric orbit on its transit to lunar encounter. Figure 4 illustrates the geometrical relations of the trajectory through lunar encounter. Figures 5 through 9 show geocentric radii (distance to probe), geocentric inertial speed, Earth–probe–Sun angle, Earth–probe–Moon angle, and Sun–probe–Moon angle versus flight time from injection to lunar encounter. At 63 hr past injection and 370,000 km from Earth, the speed of the spacecraft reached a minimum of 0.92 km/sec with respect to Earth (Fig. 6). The spacecraft accelerated thereafter due to the gravitational influence of the Moon. The geocentric postinjection orbit characteristics before and after lunar encounter are also given in Table 1.

C. *Encounter Phase*

On October 21, 1962, the spacecraft encountered the Moon, approaching in a hyperbolic selenocentric orbit with closest approach near the Moon's trailing edge. Figure 10 shows the selenocentric geometry of the flight past the Moon and illustrates the position of the spacecraft as it passed through the Moon's shadow and when it was occulted from Earth by the Moon. Closest approach occurred at 15:53:43 GMT, some 70.3 hr past injection, at a distance of 2,473 km from the center of the Moon or 735 km from its surface. Figures 11 through 17 show the trajectory characteristics during lunar encounter, including geocentric radii (distance to probe), geocentric inertial speed, Earth–probe–Sun angle, Earth–probe–Moon angle, Sun–probe–Moon angle, selenocentric altitude, and selenocentric inertial speed versus GMT. Figure 18 shows the time derivative of the range rate of the spacecraft as seen at the Goldstone Tracking Station. Because the Goldstone Tracking Station was recording the doppler signal from the capsule beacon during lunar encounter, the range rate derivative could be derived in spite of slow frequency drift of the capsule transmitter. The beginning and end of spacecraft occultation by the Moon were also observed. The capsule beacon was tracked until its signal reached DSIF threshold 11 days after launch. These data were most useful in determining the postmidcourse orbit. The selenocentric characteristics of the trajectory are shown in Table 2.

D. *Postencounter Phase*

The Moon's gravitational influence altered the spacecraft's initial geocentric orbit during lunar encounter. This resulted in an increase in energy of the spacecraft relative to Earth, so that after lunar encounter the spacecraft's orbit became hyperbolic with respect to Earth.

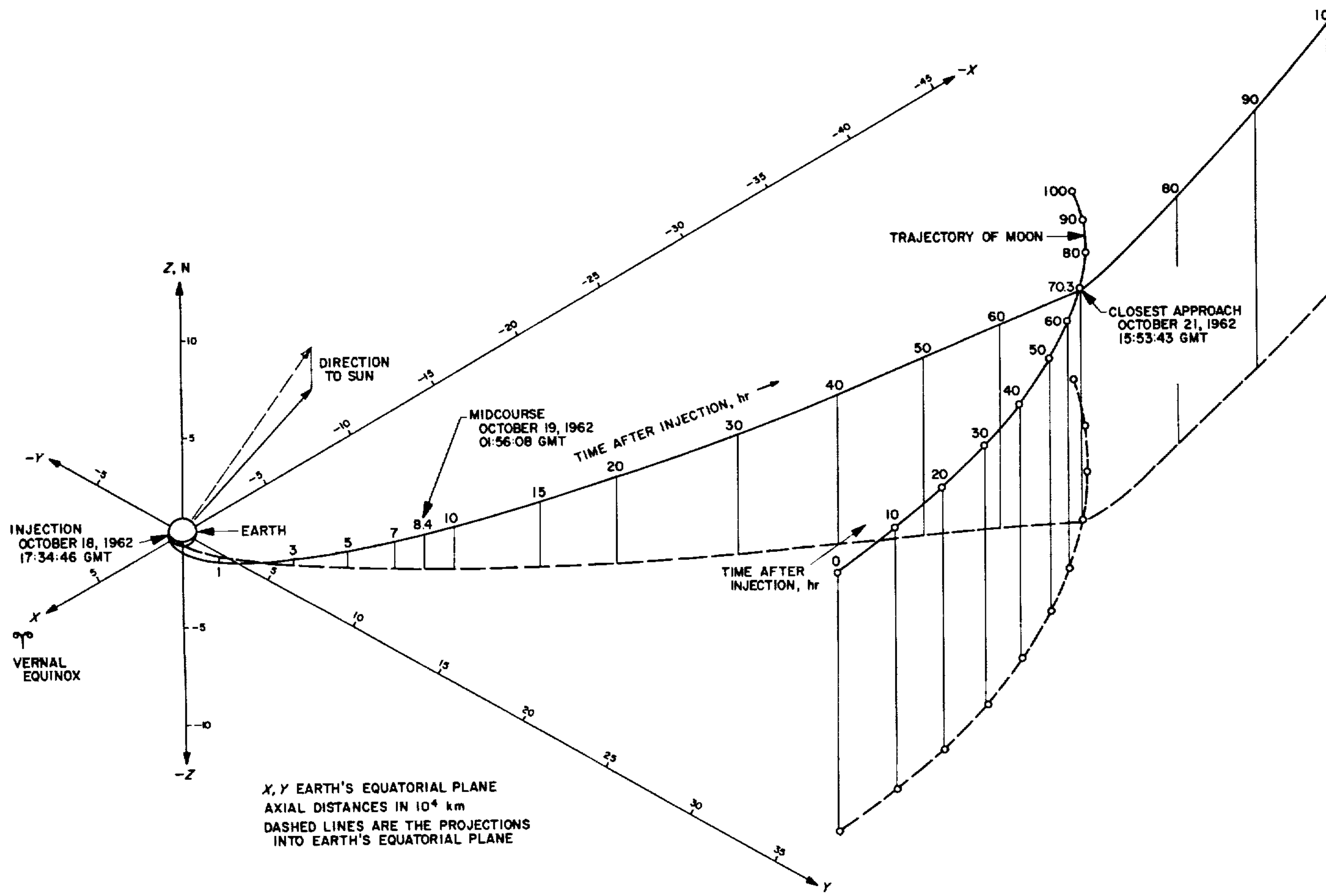

Fig. 4. ***Ranger 5*** **Earth–Moon transit geometry**

Note in Fig. 12 that an increase in geocentric inertial speed was effected by encounter. After lunar encounter the spacecraft was able to escape from the gravitational influence of the Earth–Moon system and become a satellite of the Sun in an elliptical orbit similar to the Earth's, but with greater eccentricity. The heliocentric elliptical orbit characteristics after lunar encounter are given in Table 3. The spacecraft reached a perihelion distance of 1,420,000 km on January 5, 1963. Figure 19 shows the relative positions of the spacecraft and Earth through November 25, 1963, in their respective orbits about the Sun. In March 1963 the spacecraft was at its maximum distance of 20 million km from the Earth. Its geocentric distance decreased until October 11, 1963, at which time the spacecraft encountered the Earth with a closest approach distance of 1.5 million km. The geocentric characteristics of the trajectory at encounter with Earth are listed in Table 1. Just as the geocentric orbit was altered by lunar encounter, the heliocentric orbit was altered by the October 1963 geocentric encounter. The heliocentric orbit characteristics before and after encounter with Earth are given in Table 3.

A study of the *Ranger 5* trajectory can be made by examination of the detailed trajectory printout presented in Appendices B and C. Appendix B contains the trajectory listing corresponding to the premidcourse orbit from injection to the midcourse epoch. Appendix C contains the trajectory listing corresponding to the postmidcourse orbit from midcourse through lunar encounter into the heliocentric orbit, and on through the first return encounter with Earth. Table D-1 (Appendix D) is a key to the trajectory printout. Table D-2 contains the definitions of the printed quantities. Constants and conversion factors used in all *Ranger 5* trajectory computations are listed in Table D-3. The miss parameter **B**, used to measure the miss distance for the lunar trajectory, is defined in Appendix A.

Table 2. *Ranger 5* trajectory characteristics, selenocentric

Event	Orbit	Epoch			Central body			Epoch of pericenter passage			Period
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	a	i	ω	Apogee
		r	ϕ	θ	V	γ	σ	e	Ω	ν	Perigee
At closest approach to Moon[a]	Postmidcourse	10-21-62	15:53:43.304		Moon			10-21-62	15:53:43.305		NA[b]
		2052.2633	1349.3010	291.63704	−1.2056512	1.6114740	1.0284995	−4278.6451	28.039960	14.526641	NA[b]
		2473.3475	−7.7901483	87.497005	2.2536800	−0.17023913E-4	82.230666	1.5780680	20.441789	−0.34150945E-4	2473.3479

[a] See Fig. 4. [b] Not applicable.

Table 3. *Ranger 5* trajectory characteristics, heliocentric

Event	Orbit	Epoch			Central body			Epoch of pericenter passage			Period
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	a	i	ω	Apogee
		r	ϕ	θ	V	γ	σ	e	Ω	ν	Perigee
After encounter with Moon[a]	Postmidcourse	11-8-62	00:00:00.000		Sun			1-4-63	13:43:26.688		368.97689
		0.10232351E9	0.10450206E9	347960.50	−22.833729	20.303836	0.20121688	0.15061302E9	0.40770429	81.242877	0.15905266E9
		0.14625629E9	0.13631521	45.603487	30.555939	−2.7519301	89.615704	0.05603532	26.073698	−61.712644	0.14217336E9
Prior to encounter with Earth[a]	Postmidcourse	8-5-63	00:00:00.000		Sun			1-5-64	04:32:13.250		365.41625
		0.10774806E9	−0.11365815E9	−0.100378	20.143050	20.053632	0.07081693	0.14964250E9	0.39079587	83.709337	0.15751821E9
		0.15661681E9	−0.36722170	313.47094	28.423505	−1.4024846	89.866190	0.05263014	23.450232	−153.68906	0.14176680E9
Closest approach to Earth[a]	Postmidcourse	10-11-63	07:39:44.200		Sun						
		0.14256450E9	42783543.	−7765.1250	−10.264175	28.371885	0.25552714				
		0.14884578E9	−0.00298906	16.704476	30.172545	−3.1841761	89.514180				
After encounter with Earth[a]	Postmidcourse	12-3-63	00:00:00.000		Sun			12-8-63	03:07:41.637		377.27291
		45346745.	0.13719529E9	884777.49	−29.599953	9.6200026	0.11477125	0.15286221E9	0.41033545	64.205699	0.16126079E9
		0.14449795E9	0.35083096	71.709883	31.124184	−0.28462081	89.786970	0.05494215	12.976893	−5.4720606	0.14446364E9

[a] See Fig. 19.

Table 4. Legend for tables 1, 2, and 3

Parameters	Definition		
	Earth as central body	Moon as central body	Sun as central body
X, Y, Z	Vernal equinox cartesian coordinates in a geocentric equatorial system. The origin is the center of the central body. The principal direction $\vec{X}$ is the vernal equinox direction of date, and the principal plane X, Y is the Earth equatorial plane of date. $\vec{Z}$ is along the direction of the Earth's spin axis of date, km.	Vernal equinox cartesian coordinates in a geocentric equatorial system. The origin is the center of the central body. The principal direction $\vec{X}$ is the vernal equinox direction of date, and the principal plane X, Y is the Earth equatorial plane of date. $\vec{Z}$ is along the direction of the Earth's spin axis of date, km.	Vernal equinox cartesian coordinates in a heliocentric equatorial system. The origin is the center of the Sun. The principal direction $\vec{X}$ is the vernal equinox direction of date, and the principal plane X, Y is the ecliptic plane of date. $\vec{Z}$ is normal to the ecliptic plane of date, km.
$\dot{X}, \dot{Y}, \dot{Z}$	First time derivatives of X, Y, and Z, respectively; i.e., cartesian components of the probe space-fixed velocity vector, km/sec.	First time derivatives of X, Y, and Z, respectively; i.e., cartesian components of the probe space-fixed velocity vector, km/sec.	First time derivatives of X, Y, and Z, respectively; i.e., cartesian components of the probe space-fixed velocity vector, km/sec.
r	Probe radius distance, km	Probe radius distance, km	Probe radius distance, km
ϕ	Probe geocentric latitude, deg	Probe selenocentric latitude, deg	Probe celestial latitude, deg
θ	Probe east longitude, deg	Probe selenocentric east longitude, deg	Probe celestial longitude, deg
V	Probe Earth-fixed velocity, km/sec	Probe selenocentric-fixed velocity, km/sec	Probe heliocentric inertial velocity vector, km/sec
γ	Path angle of the probe Earth-fixed velocity vector with respect to the local horizontal, deg	Path angle of the probe selenocentric-fixed velocity vector with respect to the local horizontal, deg	Path angle of the probe heliocentric inertial velocity vector with respect to the local horizontal, deg
σ	Azimuth angle of the probe Earth-fixed velocity vector measured east of true north, deg	Azimuth angle of the probe selenocentric-fixed velocity vector measured east of the Moon's mean spin axis, deg	Azimuth angle of the probe heliocentric inertial velocity vector measured east of the celestial north direction, deg
a	Semimajor axis, km (negative for hyperbolic orbit)	Semimajor axis, km (negative for hyperbolic orbit)	Semimajor axis, km
e	Eccentricity	Eccentricity	Eccentricity
i	Inclination of the orbit plane to the Earth equatorial plane, deg	Inclination of the orbit plane to the Earth equatorial plane, deg	Inclination of the orbit plane to the ecliptic, deg
Ω	Longitude of the ascending node, deg	Longitude of the ascending node, deg	Longitude of the ascending node, deg
ω	Argument of pericenter, deg	Argument of pericenter, deg	Argument of pericenter, deg
ν	True anomaly, deg	True anomaly, deg	True anomaly, deg
Period	Measured in sec	Measured in sec	Measured in days
Apogee	Measured in km	Measured in km	Measured in km
Perigee	Measured in km	Measured in km	Measured in km

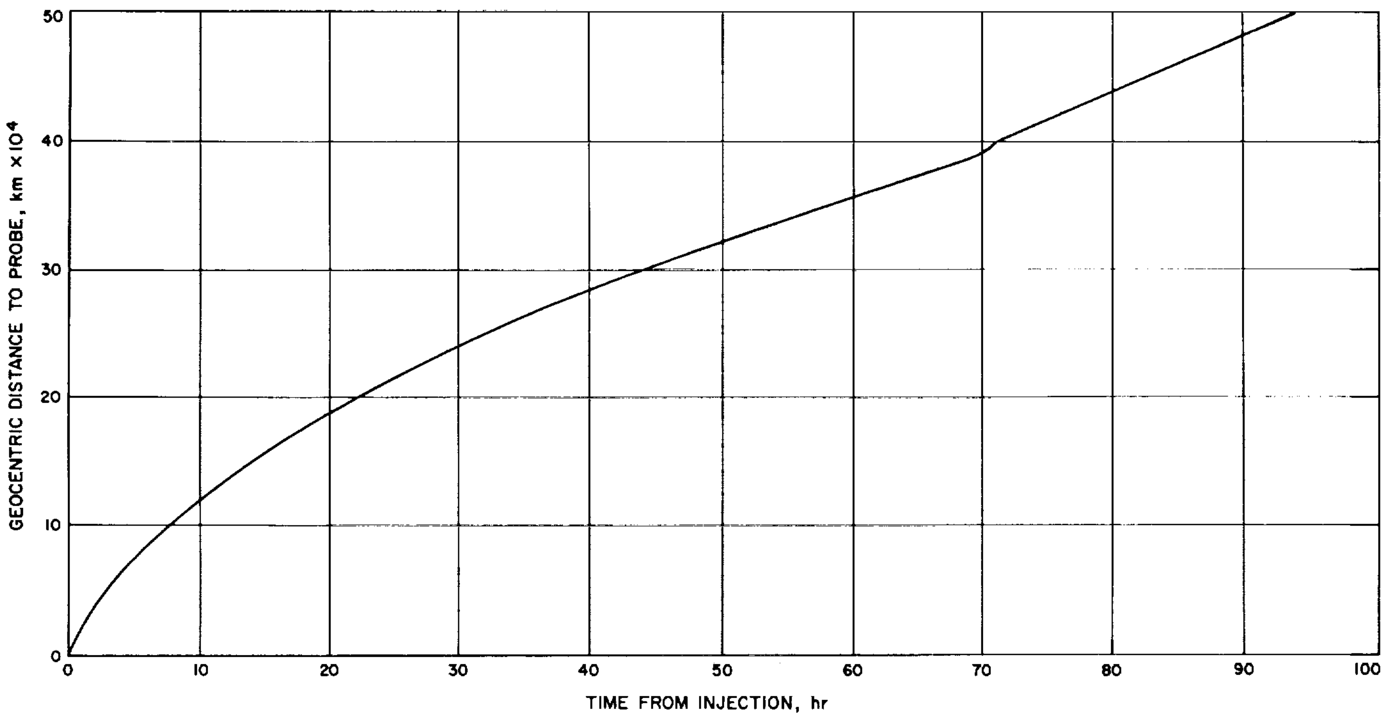

Fig. 5. Geocentric distance to probe vs. time from injection

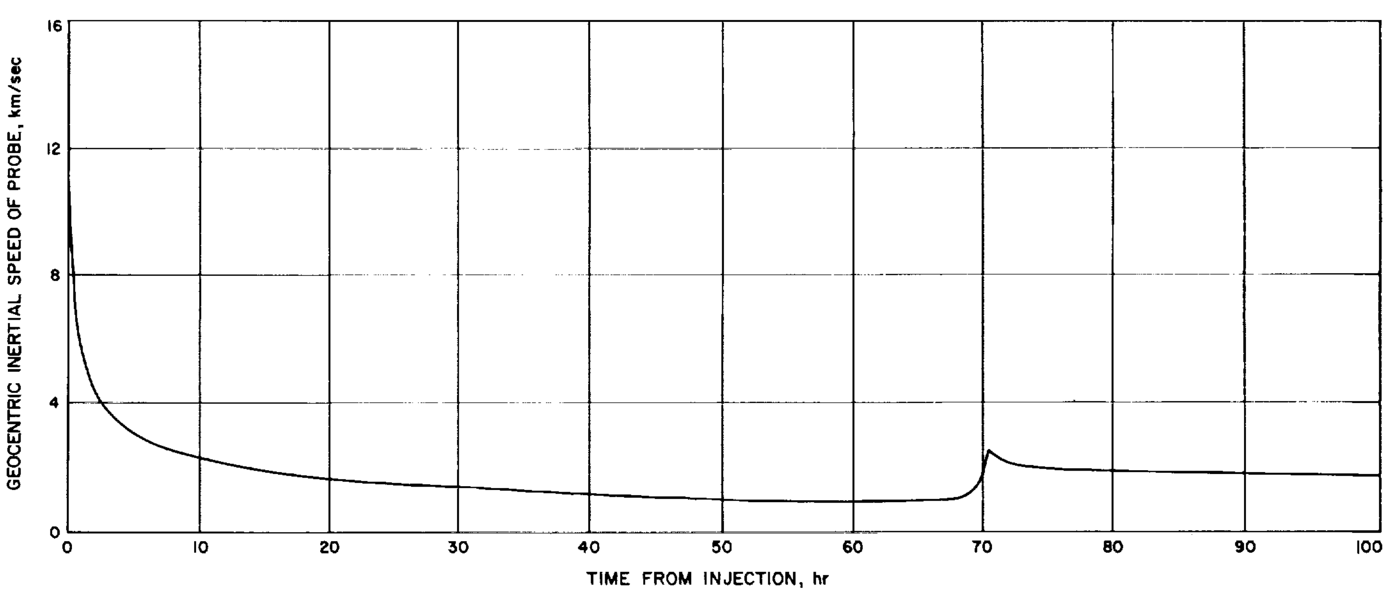

Fig. 6. Geocentric inertial speed of probe vs. time from injection

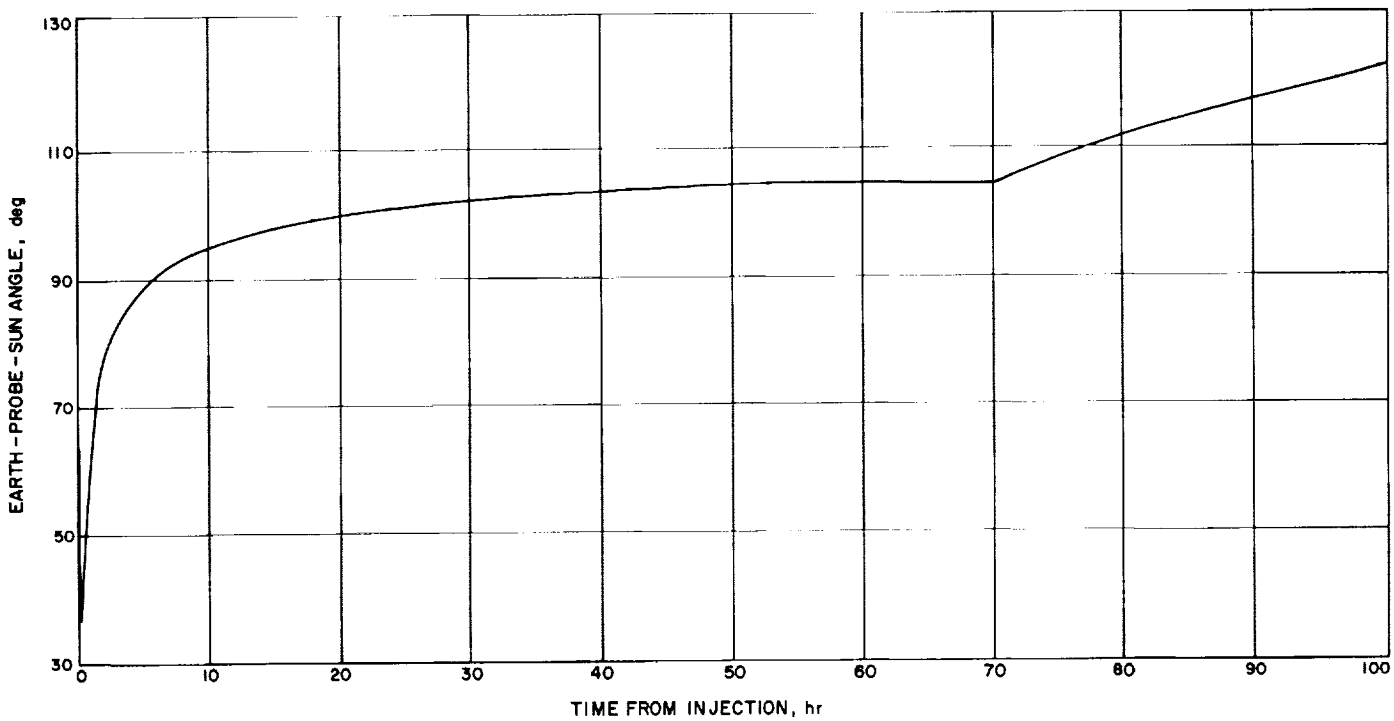

Fig. 7. Earth–probe–Sun angle vs. time from injection

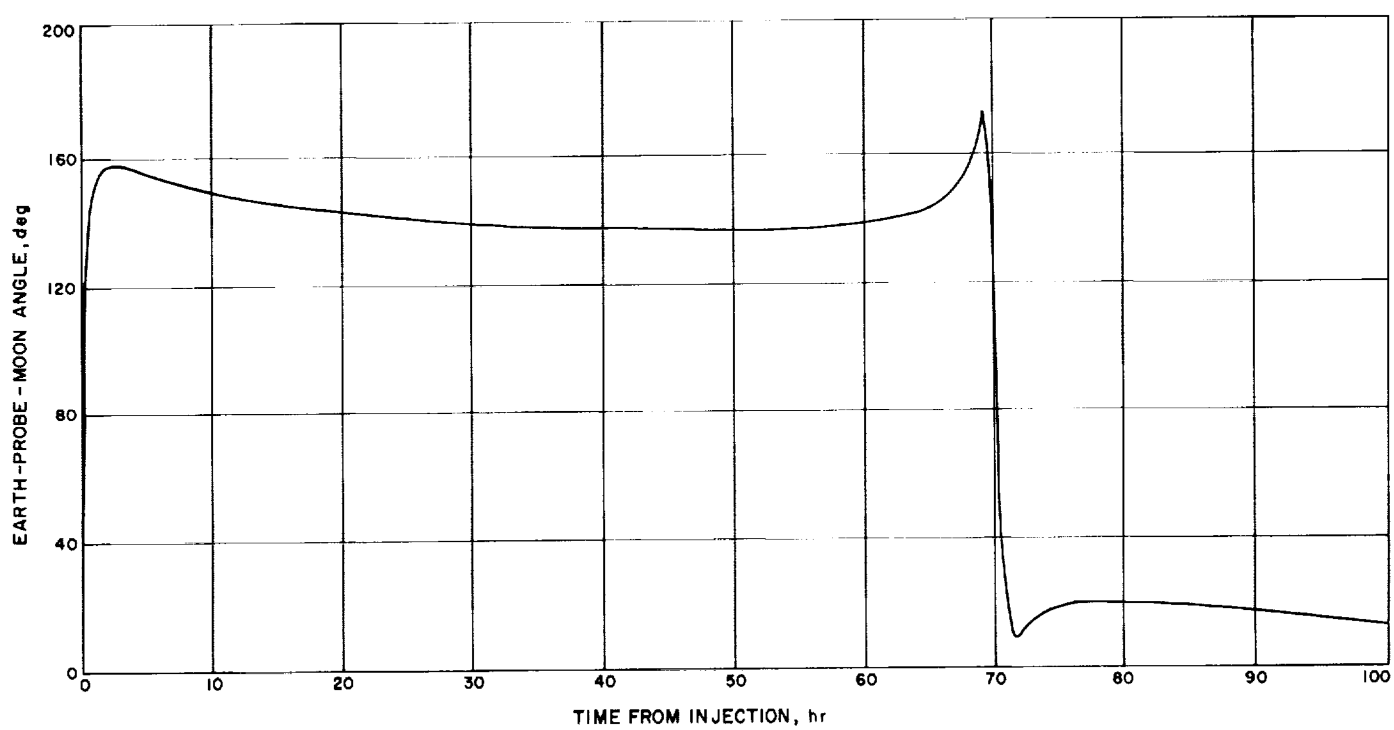

Fig. 8. Earth–probe–Moon angle vs. time from injection

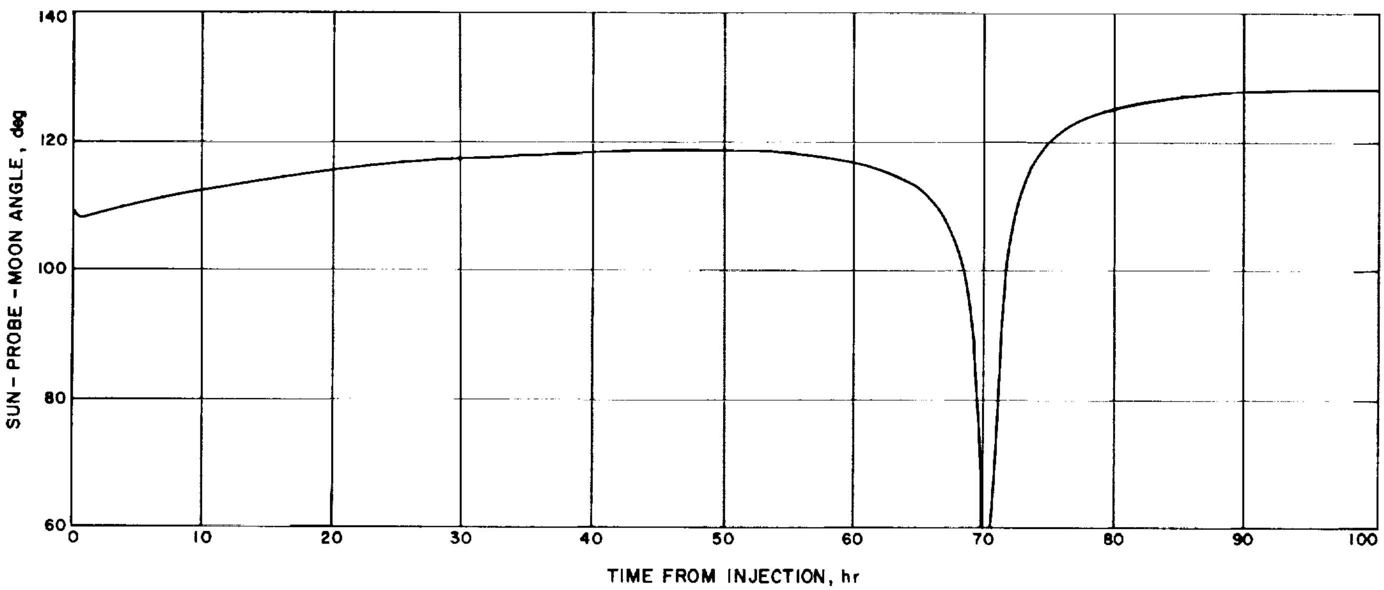

Fig. 9. Sun–probe–Moon angle vs. time from injection

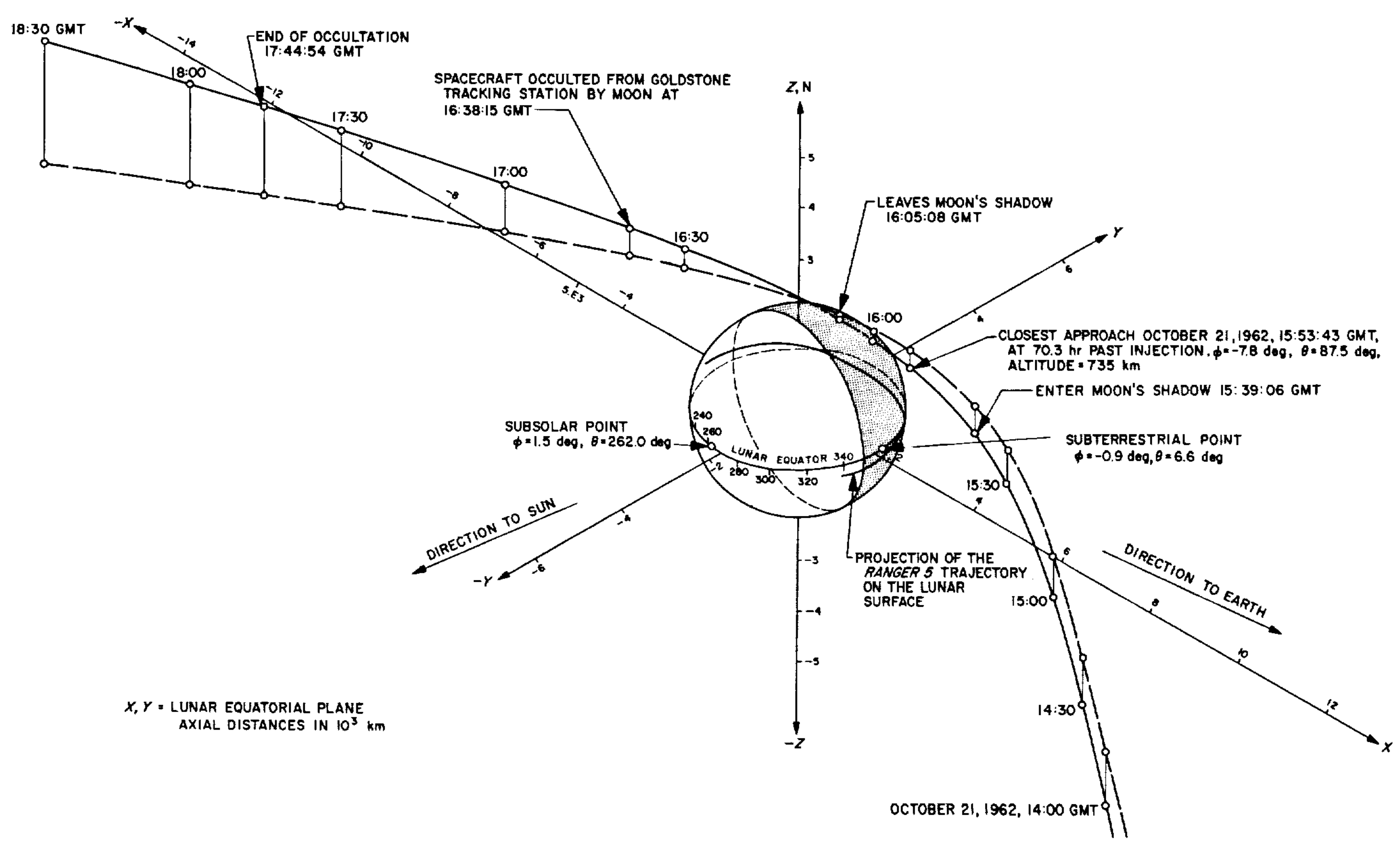

Fig. 10. *Ranger 5* lunar encounter

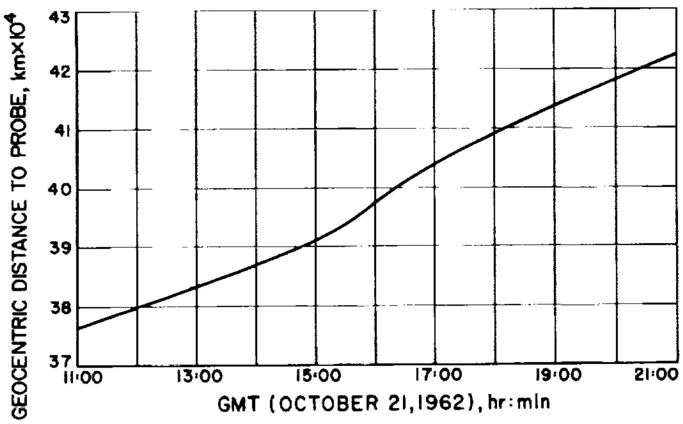

Fig. 11. Geocentric distance to probe vs. GMT during lunar encounter

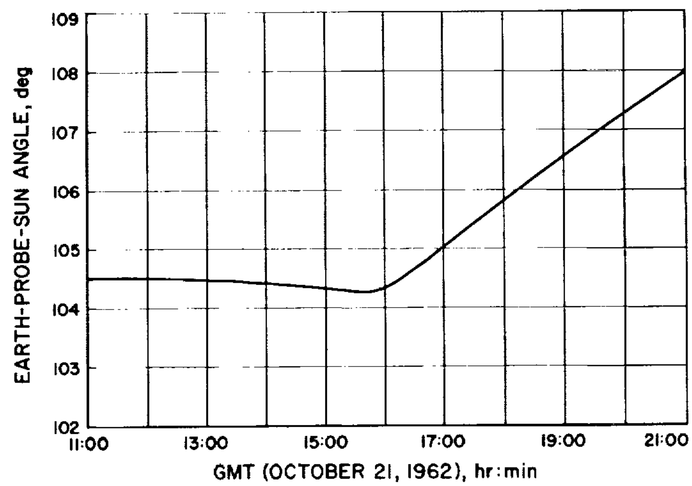

Fig. 13. Earth–probe–Sun angle vs. GMT during lunar encounter

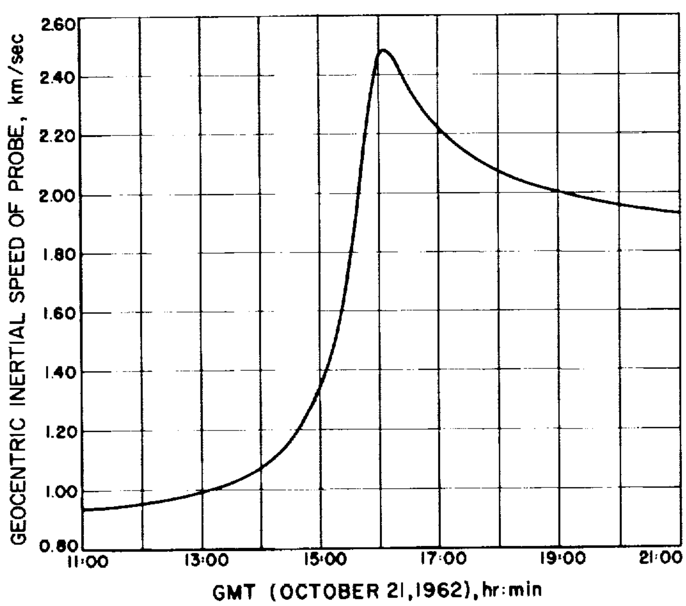

Fig. 12. Geocentric inertial speed of probe vs. GMT during lunar encounter

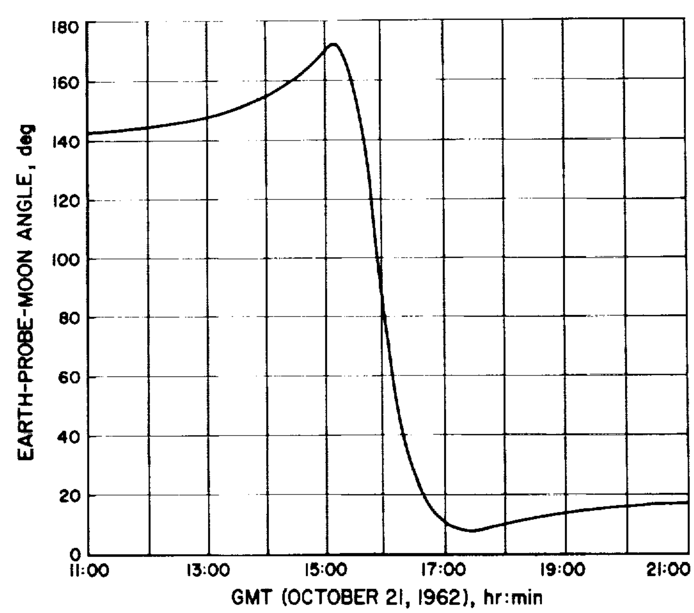

Fig. 14. Earth–probe–Moon angle vs. GMT during lunar encounter

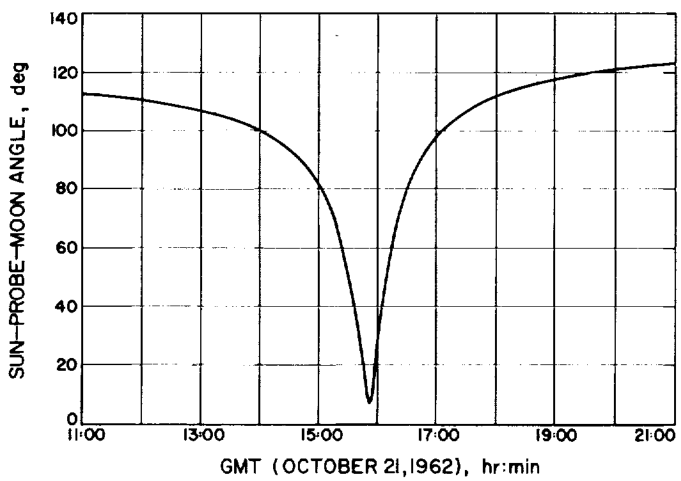

Fig. 15. Sun–probe–Moon angle vs. GMT during lunar encounter.

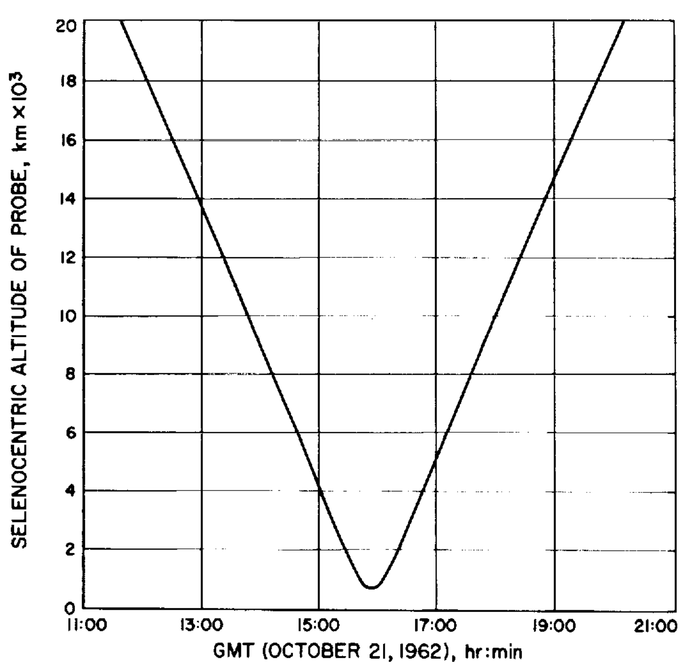

Fig. 16. Selenocentric altitude of probe vs. GMT during lunar encounter

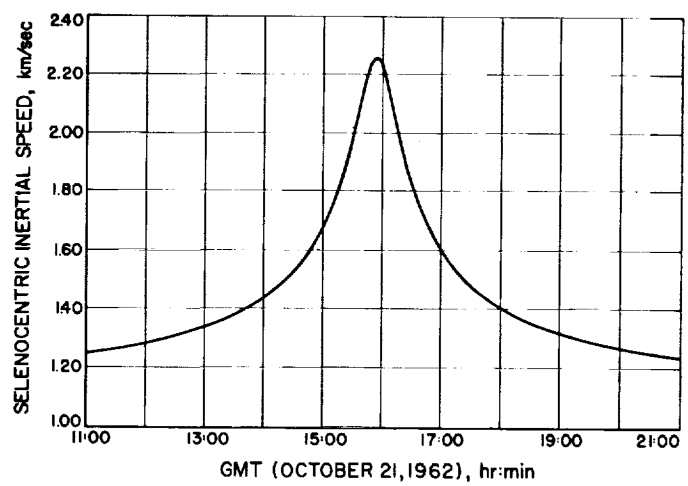

Fig. 17. Selenocentric inertial speed of probe vs. GMT during lunar encounter

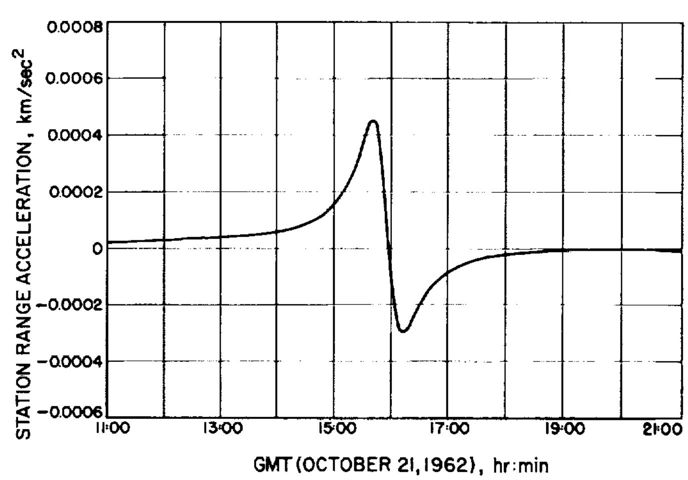

Fig. 18. Range acceleration at Goldstone for the probe vs. GMT during lunar encounter

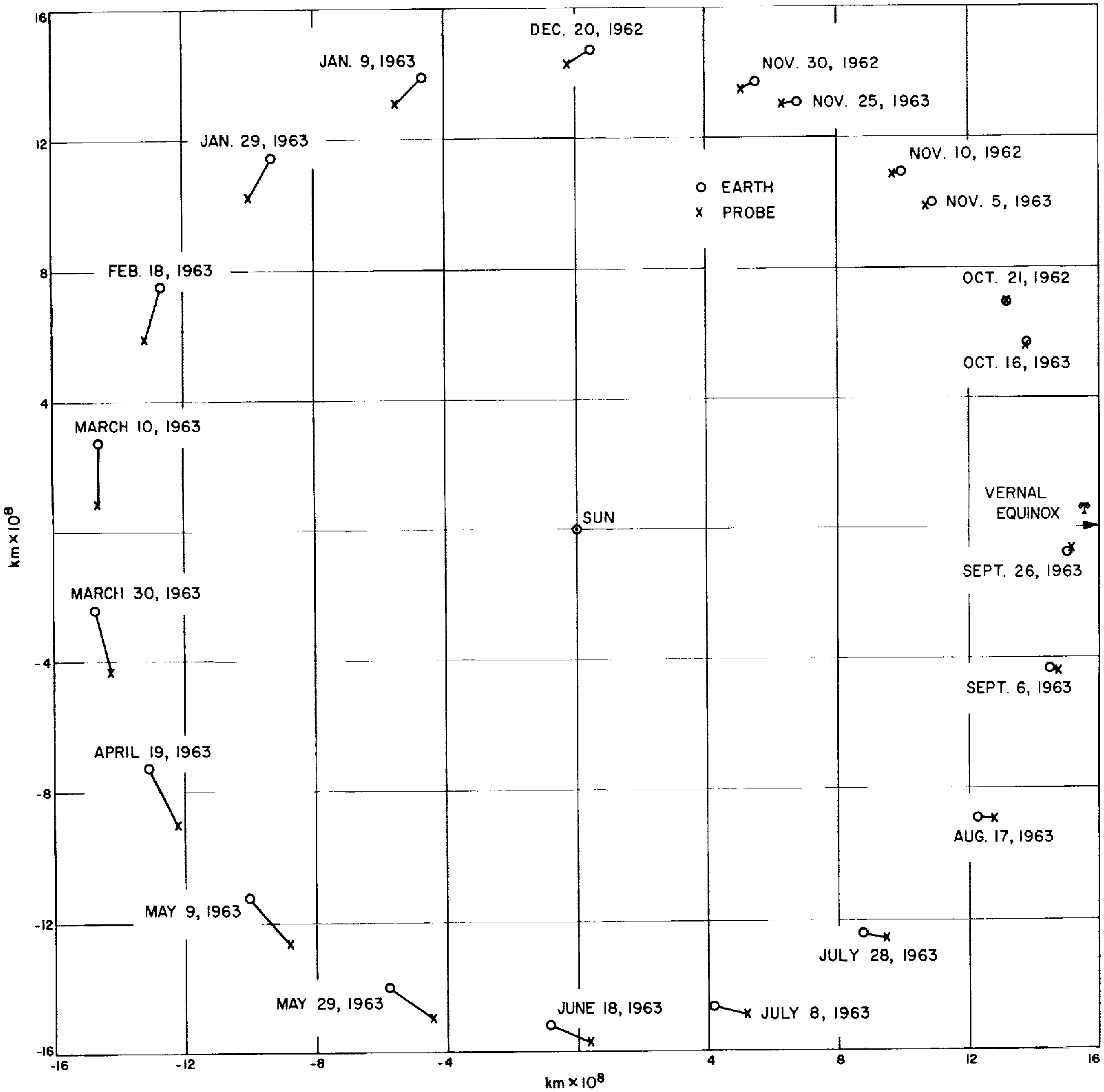

Fig. 19. Heliocentric orbits of Earth and *Ranger 5*

III. THE TRACKING SEQUENCE OF EVENTS

A. Introduction

This section summarizes the key events in the tracking of the *Ranger 5* and the *Agena* stage. Part B describes the DSIF postinjection tracking of the *Ranger 5* transponder and the payload "rough landing" capsule beacon. Part C summarizes the AMR post parking-orbit tracking of the *Agena* C-band transponder by the Twin Falls Victory (TFV) ship, the Ascension Island, FPS-16, and the Pretoria Tracking Station.

Table 5. Review of key events

	Events	Date	GMT[a]	Remarks
1	*Atlas* lift-off (L)	Oct. 18 1962	16:59:07.84	$L + 0$
2	*Agena* stage parking-orbit injection (I_1)		17:07:20.9	$L + 8^m13.1^s$
3	*Agena* stage trans-lunar orbit injection (I_2)		17:34:46.0	$L + 35^m38^s$
4	First reference epoch for orbit determination (E_1)		17:34:49.0	$L + 35^m41^s$
5	Second reference epoch for orbit determination (E_2)		17:37:23.0	$L + 38^m15^s$
6	Mechanical separation of *Agena* and spacecraft		17:37:23	$L + 38^m15^s$
7	Ignite *Agena* retro-motor		17:43:37	$L + 44^m45^s$
8	Burnout of *Agena* retromotor		17:43:57	$L + 45^m05^s$
9	Loss of transponder due to battery depletion	Oct. 19	01:46	$L + 8^h11^m$
10	Loss of capsule beacon signal due to occultation by Moon at DSIF 2	Oct. 21	16:38:14.78[b]	$L + 2^d23^h3^m$
11	Reacquisition of capsule beacon signal at DSIF 2	Oct. 21	17:44:57.06[c]	$L + 3^d0^h10^m$
12	Lost contact with beacon	Oct. 29		$L + 11^d$

[a] Universal time at occurrence of event.
[b] Corrected by −1.32 sec to account for signal travel time to DSIF 2.
[c] Corrected by −1.34 sec to account for signal travel time to DSIF 2.

To help interpret the results of the analysis of the tracking data given in Section IV of this Report, Table 5 summarizes the key events of the launch to lunar impact sequence. When comparing the *Agena* orbit with the spacecraft orbit it is important to note that *Agena* C-band transponder tracking occurs under the following conditions:

1. Before I_2, when the *Agena* rocket motor is thrusting,
2. Between I_2 and event 6, when the spacecraft and the *Agena* are still mechanically attached (the path of the combination differs from the final spacecraft orbit due to the imparting of about 0.3 m/sec relative velocity at mechanical separation),
3. Between event 6 and event 7, when the *Agena* orbit is slightly changed by the mechanical separation velocity,
4. Between events 7 and 8, when the *Agena* orbit is being changed by the retrorocket thrust,
5. After event 8, when the *Agena* orbit has undergone significant change from its orbit prior to event 7.

In using the *Agena* C-band transponder data it is quite important to employ only the data corresponding to the desired *Agena* orbit.

B. DSIF Tracking of Ranger 5 Transponder and Payload Beacon

1. General Information

The names and locations of the DSIF stations employed in the *Ranger 5* missions are given in Table 6. The detailed characteristics of the stations may be obtained from Ref. 2.

Table 7 shows the nominal visibility periods of the spacecraft to the DSIF stations during the course of the mission. Rise time refers to the time that the spacecraft first appears at a 5 deg geometrical elevation angle. All times are given in GMT. Since these are nominal periods, it is possible that signals may be received prior to "rise" and after "set" times.

Table 6. DSIF station locations

DSIF station	Location[a]	Geodetic latitude, deg	Astronomic longitude, deg	Paraboloidal antenna type	Antenna size, ft	Transmitter power ω
1	Johannesburg, S. Africa	25.9S	27.7E	AZ-EL	10	25
2	Goldstone, Calif., USA	35.4N	243.2E	HA-DEC	85	NA[b]
3	Goldstone, Calif., USA	35.3N	243.2E	HA-DEC	85	200
4	Woomera, Australia	31.4S	136.9E	HA-DEC	85	50
5	Johannesburg, S. Africa	25.9S	27.7E	HA-DEC	85	200

[a] Locations are approximate. [b] Not applicable.

Table 7. Nominal view periods at DSIF stations[a]

Date of rise	DSIF station	Rise GMT	Set GMT	View period
Oct. 18, 1962	1,5	Before injection	17:35:18	$0^h\,0^m\,29^s$
	4	17:46:31	01:55:40[b]	$8^h\,09^m\,09^s$
	1,5	22:56:47	09:41:31[b]	$10^h\,44^m\,44^s$
Oct. 19	2,3	08:23:17	20:26:42	$12^h\,03^m\,25^s$
	4	16:41:38	02:32:16[b]	$9^h\,50^m\,38^s$
	1,5	23:56:59	10:02:28[b]	$10^h\,05^m\,29^s$
Oct. 20	2,3	08:45:14	20:42:02	$11^h\,56^m\,48^s$
	4	17:01:19	02:39:47[b]	$9^h\,38^m\,29^s$
Oct. 21	1,5	00:10:46	10:07:46	$9^h\,57^m\,00^s$
	2,3	08:52:01	16:38:16[c]	$7^h\,46^m\,15^s$

[a] Based on 5-deg elevation angle and postflight transponder determined orbit. GMT at spacecraft.

[b] Set occurs on the day after rise.

[c] Loss of capsule beacon signal due to occultation by Moon.

The modes of operation of the DSIF are identified as ground modes (GM) and are defined as follows:

GM-1. Ground receiver tracks[a] the transponder signal in the 2-way mode, obtaining angles, telemetry and 2-way doppler. This type of doppler is obtained when the station receives a signal from the transponder which is being interrogated by a ground transmitter radiating through the same antenna utilized by the receiver (diplexer operation). This mode is possible at DSIF 1, 4, and 5.

GM-2. Ground receiver listens[a] for the transponder signal in the 2-way mode, obtaining telemetry and 2-way doppler. This mode is possible at DSIF 3, 4, and 5.

GM-3. Ground receiver tracks[a] the transponder signal in the 1-way mode, obtaining angles, telemetry and 1-way or 3-way noncoherent doppler. The 1-way doppler is obtained when the station receives a signal from the transponder which is not being interrogated by a ground transmitter. Accuracy of 1-way doppler is limited due to the unknown drift in the spacecraft crystal frequency. The 3-way noncoherent doppler is obtained when the station receives a signal from the transponder which is being interrogated by a ground transmitter remotely located with respect to the receiver and with no reference frequency between the two stations. Accuracy of this type of doppler is limited by variations in the reference frequency of the transmitting station. This mode is possible at DSIF 1, 4, 5.

GM-4. Ground receiver listens[a] for the transponder in the 1-way mode, obtaining telemetry and 1- or 3-way noncoherent doppler. This mode is possible at DSIF 2, 3, 4, and 5.

GM-5. Ground receiver listens[a] for the transponder in the 1-way mode, obtaining telemetry and 3-way coherent doppler. The 3-way coherent doppler is obtained when the station receives a signal from the transponder which is being interrogated by a ground transmitter located away from the receiver but with a reference frequency between the two stations. This mode is possible only with the combination DSIF 3 transmitting and DSIF 2 receiving.

GM-6. Ground transmitter is transmitting only to the transponder. No signal is received, and no doppler obtained. Used to send spacecraft commands. This mode is possible at DSIF 3 and 5.

[a]Tracking and listening capability is strictly a function of existing hardware at a station. DSIF 1 did not have listening capability.

GM-7. Ground receiver listens[a] for the capsule beacon signal in the 1-way mode, obtaining telemetry and 1-way doppler. In addition to the limitations previously cited for 1-way doppler, data obtained in this mode are degraded because of the lower, and varying, signal level of the capsule beacon. This mode is possible at DSIF 2, 3, 4, and 5.

To determine the *Ranger* 5 spacecraft orbit, all 2-way doppler data from DSIF 1, 4, and 5 plus the angular data from DSIF 5 were used. Angular data from DSIF 1 were rejected because carefully calibrated, more accurate, data were available from DSIF 5. Angular data from DSIF 4 were rejected due to extremely large variations caused by problems in the servo tracking speed. (See residual plots, Fig. 20–30.)

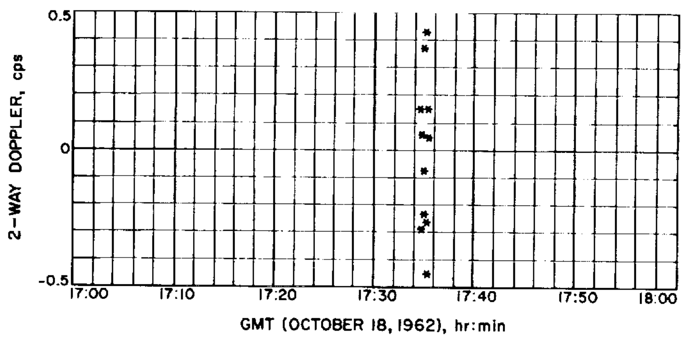

Fig. 20. Station 1 residuals (17:00 GMT)

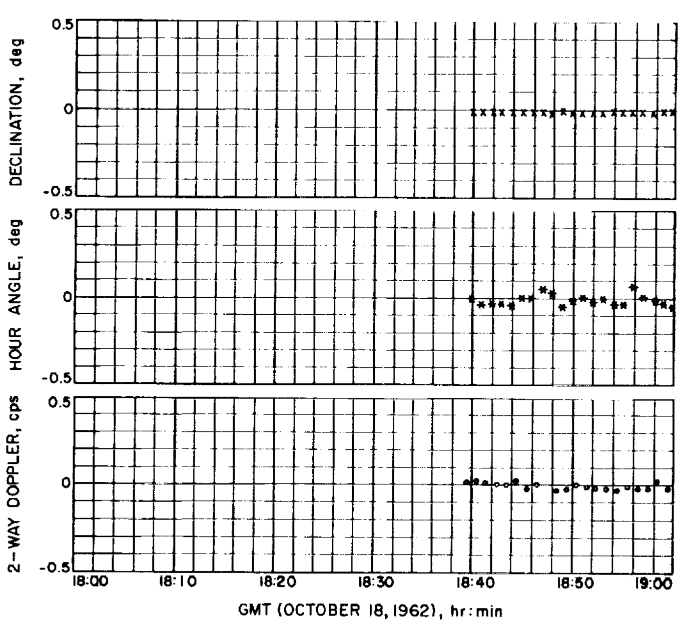

Fig. 21. Station 4 pass No. 10/181 residuals (18:00 GMT)

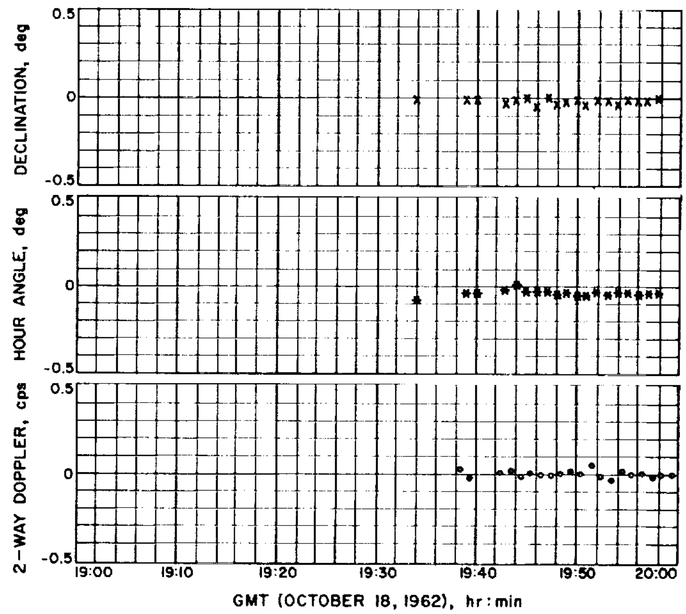

Fig. 22. Station 4 pass No. 10/181 residuals (19:00 GMT)

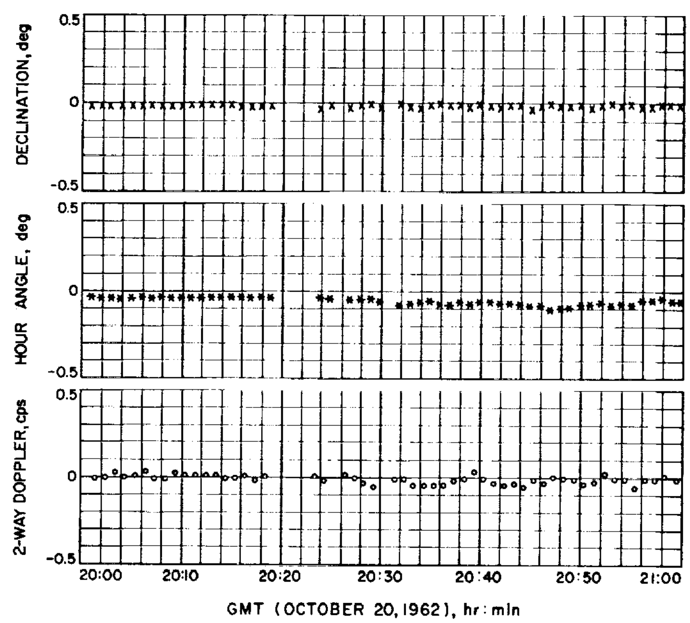

Fig. 23. Station 4 pass No. 10/181 residuals (20:00 GMT)

2. Transponder Tracking

Table 8 and Fig. 31 summarize the transmitter number q versus time, as well as the acquisition times on the first pass. The most critical times are initial acquisition in GM-3 and initial times in GM-1 during pass 1. The time interval where $q = 0$ represents the transmitter "off"

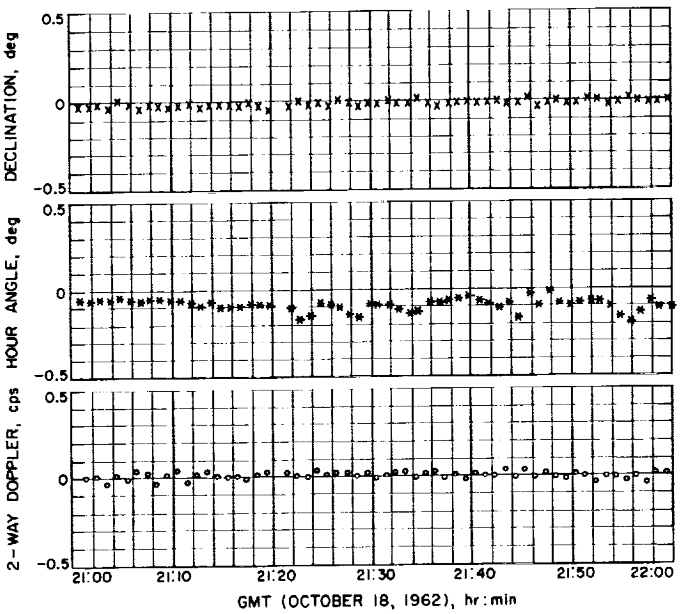

Fig. 24. Station 4 pass No. 10/181 residuals (21:00 GMT)

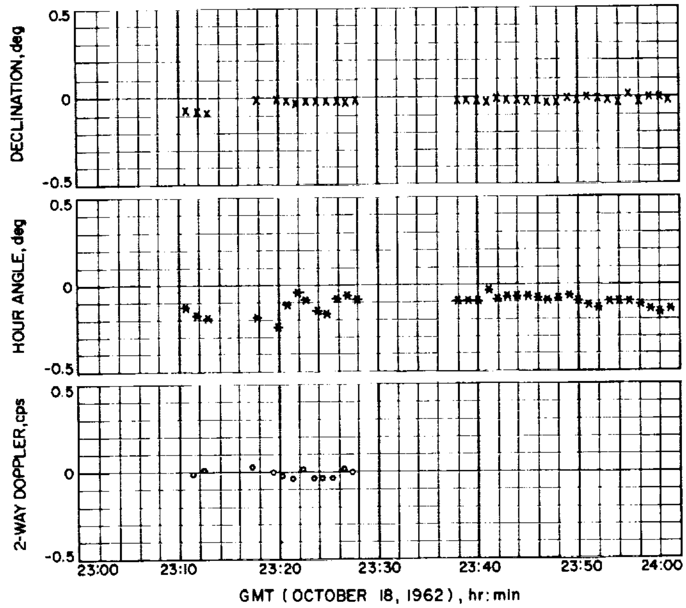

Fig. 26. Station 4 pass No. 10/181 residuals (23:00 GMT)

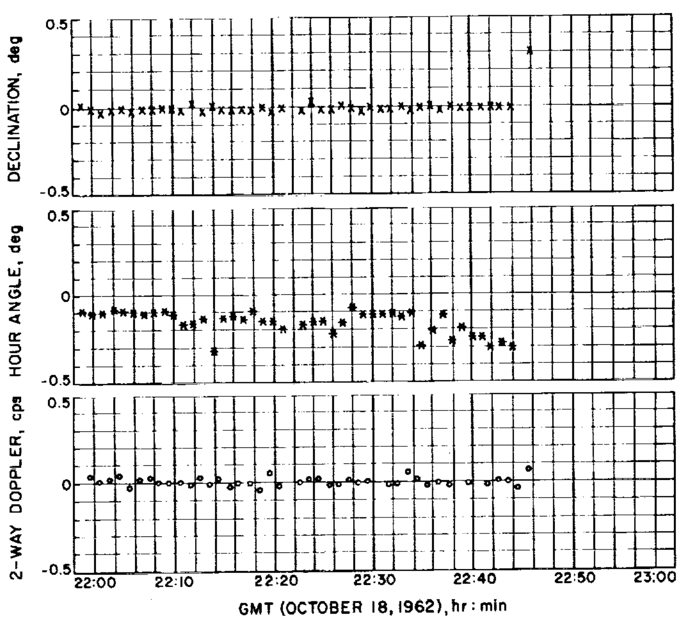

Fig. 25. Station 4 pass No. 10/181 residuals (22:00 GMT)

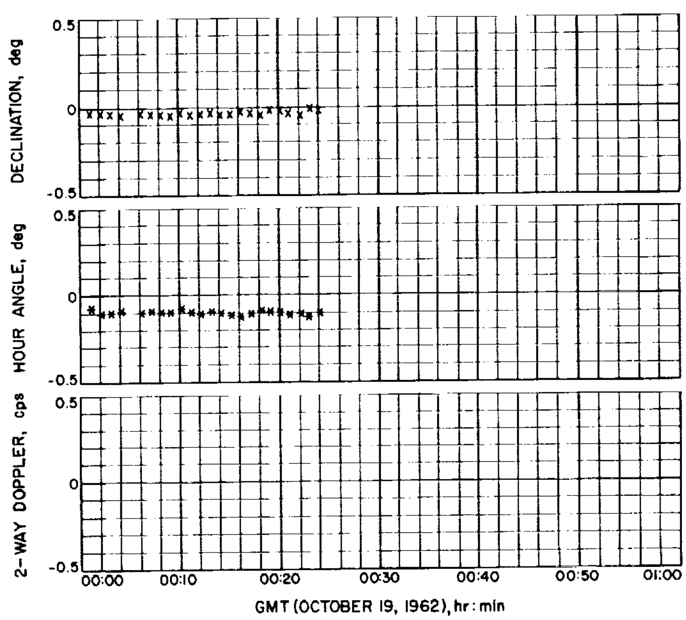

Fig. 27. Station 4 pass No. 10/181 residuals (00:00 GMT)

interval; i.e., no station is transmitting. In this instance no data were lost because the spacecraft was not within the DSIF view period. There was only a 44-sec time lag in shifting the transmitting assignment from DSIF 4 to DSIF 5. This is not evident in Table 8, since the intervals shown in the table represent the periods during which good 2-way doppler data were taken, and omit a few bad points. Station logs confirm the short time lag.

3. Capsule Beacon Tracking

On October 19, the DSIF stations began alternating between capsule beacon tracking, and searching for the transponder. In most cases, the transponder was not heard. DSIF 2 was tracking the capsule beacon when occultation occurred at 16:38:16.1 GMT on October 21. The spacecraft was reacquired at 17:44:58.4 GMT on the same day. After October 22, DSIF 2 tracked the capsule

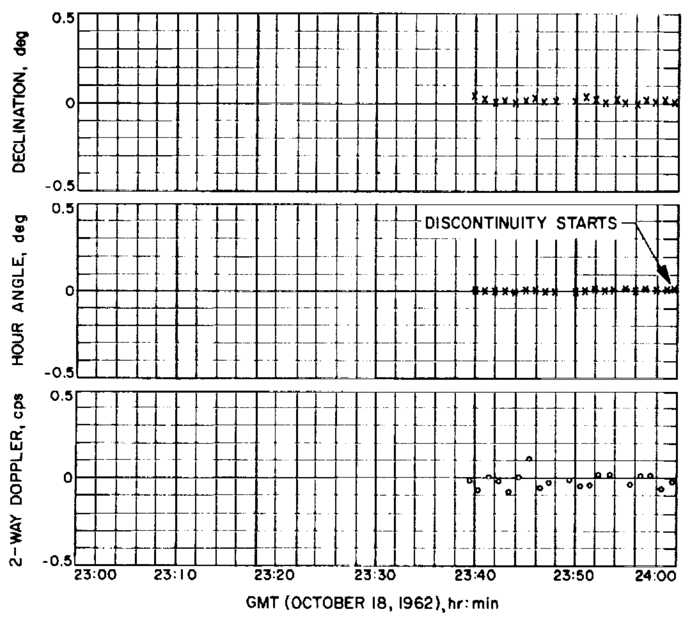

Fig. 28. Station 5 pass No. 10/182 residuals (23:00 GMT)

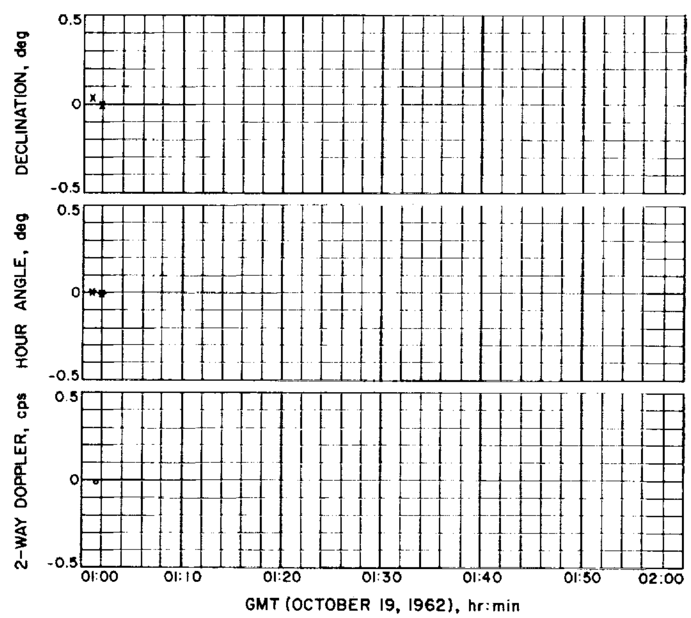

Fig. 30. Station 5 pass No. 10/182 residuals (01:00 GMT)

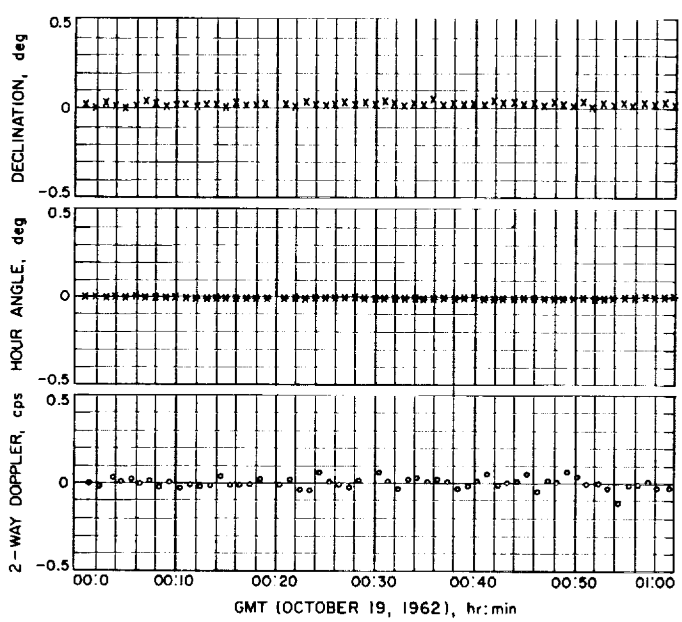

Fig. 29. Station 5 pass No. 10/182 residuals (00:00 GMT)

beacon each day for approximately 2 hr until threshold was reached on October 29. Table 9 summarizes the periods of beacon tracking for the DSIF.

4. Verification by Time of Signal Loss and Signal Reacquisition

The primary evidence of occultation of the spacecraft by the Moon is the loss of received capsule signal at the ground station. Various functions related to the received signal are recorded by the DSIF on magnetic tape and independently on direct-write oscillographs.

Figure 32 is a playback of a recording of the receiver functions recorded on magnetic tape at DSIF 2 for the last few seconds prior to occultation. In the figure, the trace labeled SIGNAL STRENGTH is the one of critical interest. At the time noted by the arrow (16:38:16), the signal started to decay. The rate of decay is characteristic of the 10-sec AGC time constant in the receiver.

The time associated with the event is determined from a binary-coded-decimal (BCD) time code which records days, hours, and minutes, from a 1 pulse/sec time code. Both the BCD code and 1 pulse/sec code are derived from the station secondary standard which is synchronized to WWV. The playback mechanism for the magnetic tape precludes the direct display of the BCD code. In order to display time with the playback, a time translator is synchronized with the BCD code. The output of the time translator appears as a 1 pulse/sec trace in Fig. 32. A 6 pulses/min and a 1 pulse/min trace, both from the translator, may also be seen in the figure. The trace labeled ACQUISITION RELAY is an event channel which marks loss of receiver lock; i.e., loss of signal. The change of state of this relay is consistent with the time of signal tail-off seen in the SIGNAL STRENGTH

Table 8. Transmitter number and acquisition times[a]

Transmitter number q	Time interval	Receiving station i	Ground mode GM	Acquisition[c] time GMT 18 and 19 Oct	Acquisition time vs. rise time
1	Injection epoch to t_1 = 17:37:07	1	1	17:31:25	Set − 3^m53^s
0	t_1 to t_2 = 17:48:00	—		—	—
4	t_2 to t_3 = 23:28:51	4 5 1	1 3 3	18:38:51 23:00:02 22:33:23[d]	Rise + 52^m20^s [b] Rise + 3^m15^s Rise − 23^m24^s
5	t_3 to t_4 = 01:43:51	4 5 1	3 1 3	23:38:02 23:32:21 23:30:07	11^m2^s [e] 5^m41^s [e] 7^m55^s [e]

[a] Reference 3 plus Section IV of this Report. Times measured from "rise" refer to rise time at the receiving station listed.

[b] Signal was heard at 17^h 45^m, but because of trouble in the servo tracking speed, two-way doppler lock was not achieved at first. Another significant factor was a series of false two-way lock indications with the transmitter VCO below the proper lock frequency.

[c] Acquisition time is the time of the first good data point.

[d] Acquired below 5-deg elevation.

[e] Time shown here is the interval between transmitter "on" time and time of first good data point.

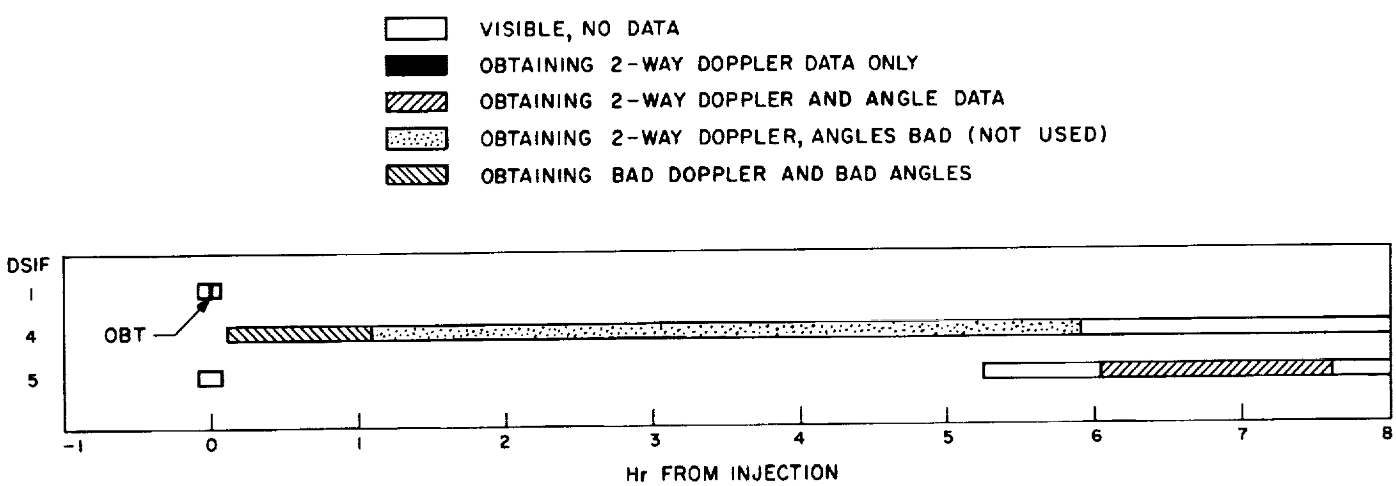

Fig. 31. Tracking station view periods for *Ranger 5* mission and their data coverage

trace. Certain areas to the right of occultation time appear to indicate receiver "in-lock". This is most likely caused by noise bursts or transients. It is definitely not a signal since the signal strength trace is wandering about the reference line.

The conclusion is that the spacecraft was occulted by the Moon at 16:38:16.1 GMT on October 21 minus the signal transmission time. The accuracy to which this time can be determined is approximately ±0.1 sec.

Figure 33 is a playback of the same magnetic tape from DSIF 2 for a few seconds prior to the time that the spacecraft reappeared after being occulted by the Moon. Again the SIGNAL STRENGTH trace is the one of primary interest. At the time noted by the arrow (17:44:58.4), a signal was received from the capsule. Prior to this time, the SIGNAL STRENGTH trace had been wandering about the reference line. Capsule signal acquisition time is also verified by the change in state of the ACQUISITION RELAY.

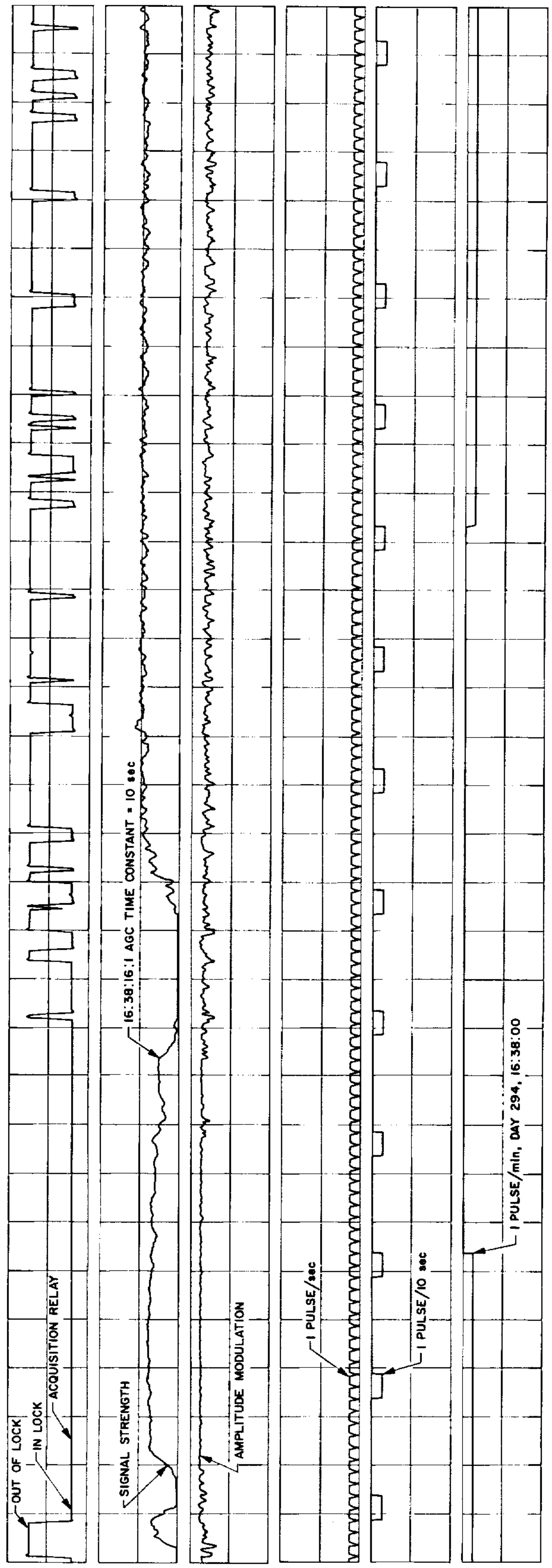

Fig. 32. Station 2 receiver functions prior to occultation

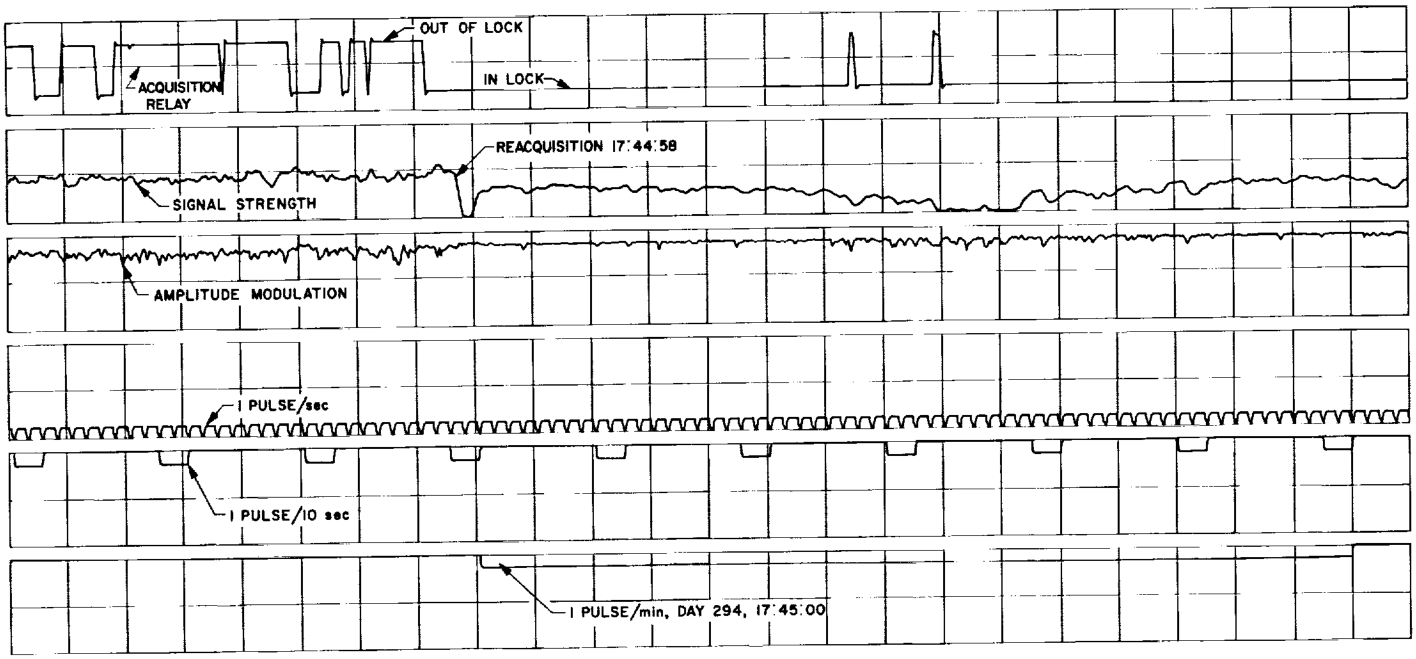

Fig. 33. Station 2 receiver functions after occultation

Table 9. Summary of capsule beacon tracking

Date	DSIF station	Acquisition GMT	End of track GMT
Oct. 19, 1962	4	01:19:00	01:22:14
	4	01:58:32	02:26:50
	4	16:35:00	02:30:00[b]
	5	02:36:40	04:00:00
	5	04:35:00	04:44:00
	2	08:35:00	14:39:02
	3	08:46:00	08:50:12
	3	15:32:00	17:05:00
	3	18:54:30	19:08:20
Oct. 20	4	17:08:00	02:44:11[b]
	5	00:37:40	10:00:00
	3	10:19:00	20:30:00
Oct. 21	4	18:25:52	02:40:00[b]
	5	00:10:00	09:00:10
	2	08:53:00	16:38:16.1[c]
	2	17:44:58.4[d]	20:45:00
	3	17:47:50	18:14:00
Oct. 22	5	05:30:00	07:30:00
	2	19:04:00	20:15:00
Oct. 23–29	2[a]		

[a] Station tracked for approximately 2 hr each day. Threshold was reached on October 29.

[b] End of track occurred next day.

[c] Occultation.

[d] Reacquisition after occultation.

It must be noted that reacquisition time is a function of the accuracy of the tracking predictions. Therefore, it cannot be definitely concluded from Fig. 33 that the time noted by the arrow represents the earliest possible moment that a signal could have been received. Hence, it merely indicates the time that the station reacquired the capsule signal.

DSIF 3 did not attempt to observe occultation because it was assigned to searching for the transponder signal.

DSIF 4 could not physically view the occultation. End-of-occultation was available, but the capsule signal was not locked up until 34 min after reappearance.

C. *AMR Tracking*

Tracking data were received in real time from the AMR radars on Antigua and Ascension Islands. Since injection occurred over South Africa, these stations did not track the *Agena* C-band transponder in the final transfer orbit. However, data from these stations, together with several minutes of data from the radar at Pretoria, were used to give a good estimate of the parking orbit, which in turn was used, together with an assumed nominal second stage burn of the *Agena*, to provide acquisition information for subsequent tracking.

The radar at Pretoria tracked the C-band transponder when it rose 2 deg above the horizon and maintained track until about 20 sec before *Agena* second burnout. At that time the radar lost track, and from then on the data were poor until complete loss of signal, at the horizon, at about 17:37:00.

The TFV ship sent back raw radar data in real time. These data were uncorrected for the pitch and roll of the ship, due to the failure of the computer on board. Later, however, the data were corrected at Cape Canaveral and retransmitted. These data covered the time span from 17:40:18 to 17:45:48 thus including the occurrence of the spring separation. These data have not yet been analyzed. Table 10 summarizes the available AMR raw data.

Table 10. *Ranger 5* AMR raw data summary

AMR station	Time points during parking orbit	Remarks
Antigua	28	
Ascension	33	
Pretoria	14	Good data continued on thru 2nd *Agena* burn, until about 17:34:24.
	After epoch E_1	
Pretoria	19	Only 4 data time points indicated "in lock".
TFV Ship	51	

IV. FLIGHT PATH DETERMINATION USING TRANSPONDER TRACKING

A. Introduction

The real-time determination of the parking orbit is the responsibility of the AMR. Their preinjection tracking of the *Agena* vehicle C-band transponder is important in establishing the parking orbit and detecting nonstandard flight conditions. The AMR supplies the Jet Propulsion Laboratory (JPL), Pasadena, California, with parking orbit elements and initial acquisition information for transmittal to the DSIF stations and for preliminary estimation of the spacecraft injection conditions. The only postinjection tracking of the spacecraft is done by the DSIF. Postinjection orbit tracking of the *Agena* may be incorporated with the DSIF data. In the present case the paucity of postinjection data from land stations and the difficulty of accounting for the additional error sources

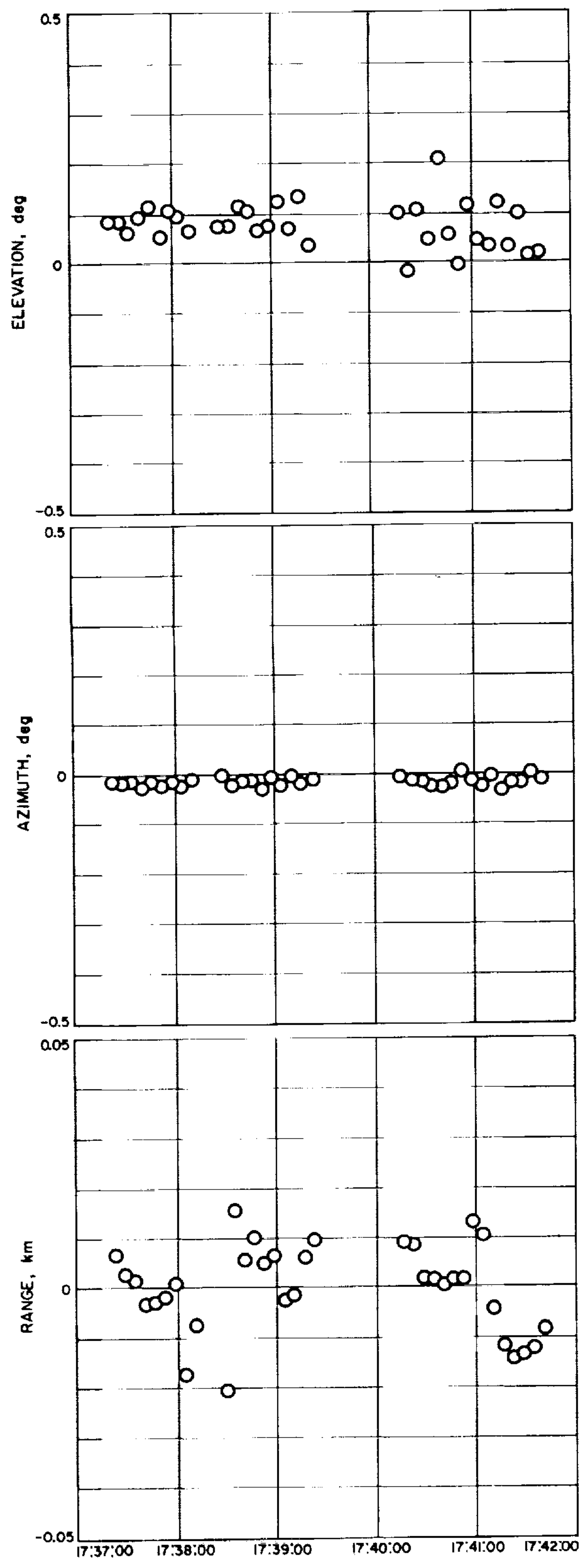

Fig. 34. TFV ship residuals based on orbit determination by ship range and DSIF data

in ship tracking data (ship's velocity) has precluded comparisons between the AMR data and the DSIF orbit. However, an orbit was obtained which fitted the TFV ship range data[b] after separation and fitted the DSIF-determined spacecraft orbit (corrected for *Agena* separation velocity). The residuals are shown in Fig. 34. Trial and error methods were used to obtain estimates of the ship speed, heading and range bias. Values obtained were:

Ship speed	3.5 ± 0.5 yd/sec
Ship azimuth east of north	110 ± 10 deg
Range bias	+700 ± 100 yd

B. *Flight Path Determination Using DSIF Tracking of the Spacecraft Transponder*

1. Summary of Data Taken

The complete sequence of tracking events and ground tracking modes is described in Section III. The estimation method used is discussed in Section VI. Angle tracking data were used whenever the DSIF stations were in GM-1 or -3 and the "data condition" code indicated good data. Doppler was used only when the stations were in GM-1.

Table 11 provides a gross picture of the performance of the data handling system; column 3 gives the total number of data points received at each station during the life of the spacecraft transponder. The editing of the data, described in Section VI, allowed the number of points (and percentage of total) listed in column 4 to be used in the final orbit determination. Of particular interest is the number and percentage of data sets rejected for bad format or as "blunder points". No attempt is made to unscramble data messages containing format errors. "Blunder points" can create significant problems in converging on an orbit when very little data are available. Hence, they are important in influencing the time required to establish our first estimate of the orbit. The number and percentage of the points omitted because of "bad data condition" are listed in column 7. When the tracking station operators or automatic detectors recognized that the data being transmitted would not be usable, the data condition codeword reflected these situations. This situation occurs when retuning the ground

[b]Angles from the ship were not used because of systematic orientation errors.

Table 11. Summary of data used in orbit determination

DSIF station	Data types	Points received	Points used	Bad format rejection	Blunder points	Bad data condition	Rejection limits on blunder points
		% of received	% of received	% of received	% of received	% of received	
1	2-way doppler	12	12[a]	0	0	0	1 cps
		100	100	0	0	0	
4	2-way doppler	301	214	5	1	81	0.15 cps
		100	71	1.7	0.3	27.0	
5	2-way doppler and hour angle declination	102	82	4	0	16	0.15 cps
		100	80	4.0	0	16.0	0.15 deg

[a] There is one more data point here than listed in ODP printout, because two adjacent continuous count data points are differenced to obtain a data point for the ODP.

transmitter to maximize the signal received at the spacecraft when commands are being sent, and during the acquisition phase.

DSIF 1 data actually occurred prior to separation of the spacecraft and the *Agena*. Therefore, its data were used only for *a priori* knowledge of position and velocity and were not used in the final orbit computation of residuals where only DSIF 4 and 5 data were used.

Table 12. Summary of weights, sample and count times

DSIF station	Data type	[a]E to $E + 7^h\,30^m$		
		Sample spacing, sec	Count[c] time, sec	Weight, cps[b] or deg
1	2-way doppler	5	continuous	1.1–2.2[d]
4	2-way doppler	60	50	0.184
5	2-way doppler	60	50	0.188
5	Hour angle, declination	60	—	0.185

[a] E is reference epoch used for orbit determination (Table 5).

[b] $1 \text{ cps} = \frac{c}{2f} = 0.156$ m/sec where the transmitting frequency, f, is 960×10^6 cps.

[c] Stations time tag the data at the end of the counting interval.

[d] These weights are high due to the refraction uncertainties, since these data are taken close to the horizon.

2. Weighting of the Data

The data weights were assigned in accordance with the policy described in Section VI. The weighting assigned to the data depends upon the sampling interval, elevation angle, counting time and range to the spacecraft. During the flight the effective noise due to variation of the transmitter reference frequency was calculated by regular recording of the transmitter frequency. The noise in the doppler due to this variation never became a dominant factor because the oscillator performance exceeded specifications and because transponder tracking ended prematurely. Table 12 summarizes the sampling, counting intervals and weighting used.

3. Discussion of Residuals

Once the data points and weights are fixed, the set of initial conditions which minimizes the weighted sum of the residuals squared is found by an iterative method. The differences between the vector of all observations and the calculated values based on the converged solution is called the vector of residuals. Figures 20 through 30 are the residual plots, by DSIF station, vs. time for the data types used in the final orbit. The detailed analysis of the residuals is published in Ref. 4 and 5. No particular characteristics display themselves as in *Ranger 4* (tumbling), except for the bad angles at DSIF 4 which were not used because of a servo tracking problem and because of a discontinuity in hour angle at DSIF 5, due

to the refraction correction discontinuity[c] (Fig. 28 and 29 at edge of frame).

[c]Refraction correction is handled by two polynomials, one for above 17 deg elevation and one for below. There is a slight discontinuity between the two at 17 deg.

Table 13. Tracking noise statistics

DSIF station	Data type	No. of points	RMS	Mean
1	2-way doppler, cps	11	0.269	−0.006
4	2-way doppler, cps	213	0.022	−0.0001
5	2-way doppler, cps	81	0.033	−0.002
5	hour angle, deg	81	0.008	−0.003[a]
5	declination, deg	81	0.023	+0.021[a]

[a] Antenna angle biases were calibrated out.

4. Statistics of Data and Orbital Estimates

a. Tracking data statistics. The root-mean-squared (RMS) noise and mean of the residuals for each station is given in Table 13 for each data type used. Note that the RMS noise and weights of Table 12 differ significantly in most cases. The difference in angle weighting is due to the presence of low-frequency mechanical deflection of the DSIF antennas. As for the doppler data, the point has now been reached where any small unknown correlation or bias could give erroneous results. Therefore, conservative weighting is applied until conclusive results show that there exists no other error source to be considered in the doppler weighting.

b. Statistics of orbit estimate. The accuracy of the orbit obtained depends on the statistics of the tracking noise and on the statistics of all error sources which influence the orbital estimate. The tracking noise statistics

Table 14. Statistics of knowledge of injection conditions including physical constant uncertainties

Space fixed cartesian coordinates

Standard deviation		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$	$GM_\oplus$	$GM_☾$
X	0.1215 km	1	0.164	0.224	0.233	0.221	0.372	0.438	−0.0046
Y	0.6160 km	Symmetrical	1	0.950	0.829	0.960	0.796	0.636	−0.013
Z	1.1887 km			1	0.959	0.995	0.937	0.610	−0.013
$\dot{X}$	1.2191 m/sec				1	0.939	0.977	0.571	−0.011
$\dot{Y}$	0.6814 m/sec					1	0,928	0.597	−0.012
$\dot{Z}$	1.8096 m/sec						1	0.520	−0.012
$GM_\oplus$	3.8332 km^3/sec^2							1	−0.002
$GM_☾$	4.9997 km^3/sec^2								1

Earth fixed spherical coordinates

Standard deviation		R	ϕ	λ	V	γ	σ
R	0.6594 km	1	−0.970	−0.958	−0.997	−0.922	0.918
ϕ	0.008570 deg	Symmetrical	1	0.944	0.967	0.860	−0.978
λ	0.005574 deg			1	0.966	0.946	−0.864
V	0.5603 m/sec				1	0.941	−0.907
γ	0.003295 deg					1	−0.753
σ	0.01303 deg						1

are represented by the "equivalent or worse" white noise method described in Section VI. The *Ranger 5* ODP does "solve for" and can directly include the effects of deviations in physical constants such as *GM-Earth* ($GM_{\oplus}$), *GM-Moon* ($GM_{☾}$), and station locations. Table 14 gives the covariance matrix describing the uncertainty in the space-fixed cartesian and also Earth-fixed spherical coordinates at the reference epoch, E_2[d], where the physical constants are in the estimator. (Note Table 15 for an *a priori* on physical constants.) The covariance matrix is given in terms of its correlation matrix and standard deviations of the coordinates. Table 16 shows the effect when uncertainties in physical constants are not included in the solution parameters.

[d]Between E_1 and E_2 the spacecraft was tracked by DSIF 1 and there was an accumulation of these data into a covariance matrix at E_1. This covariance was then mapped to the separation epoch, corrupted by the separation and used as *a priori* for the final data orbit.

Table 15. Standard deviations of estimated parameters

Parameters	Without physical constants	With physical constants	*A priori* 1-sigma
X km	0.096	0.121	
Y km	0.368	0.616	
Z km	0.657	1.189	None
DX km/sec	0.726×10^{-3}	1.219×10^{-3}	
DY km/sec	0.372×10^{-3}	0.681×10^{-3}	
DZ km/sec	0.932×10^{-3}	1.810×10^{-3}	
$GM_{\oplus}$ km^3/sec^2		3.833	4.0
$GM_{☾}$ km^3/sec^2		5.00	5.0
DSIF 4			
radius, km		0.0599	0.060
latitude, deg		0.00099	0.001
longitude, deg		0.00098	0.001
DSIF 5			
radius, km		0.0598	0.060
latitude, deg		0.00099	0.001
longitude, deg		0.00098	0.001
R km	0.4281	0.6594	
ϕ deg	0.0045	0.0086	
λ deg	0.0032	0.0056	None
V km/sec	0.3515×10^{-3}	0.5603×10^{-3}	
γ deg	0.0021	0.0033	
σ deg	0.0068	0.0130	

Although the estimation of these physical constants from *Ranger 5* tracking data has not contributed much to the improvement in their values, the actual estimator of target conditions is statistically better than that which would be obtained by ignoring the fact that these constants are uncertain. At the same time the better estimator has the property of giving a realistic description of its accuracy. It is important that in-flight actions be based on realistic error estimates.

Table 17 summarizes the difference in the solution vectors of estimating with and without physical constants. The differences are well within the standard deviations for either case as can be seen in Table 15. Also from Table 15 the relative strength of the data in furnishing new information on physical constants can be observed.

The covariance of errors in knowledge of the coordinates at E_2 may be "mapped" to the target region using the miss parameters **B** (Appendix A) and T_L, the linearized time-of-flight, as measures of target error. T_L may be considered to represent the flight time to a vertical impact. (The influence of **B** on the parameter T_L is thus removed.) Table 18 represents the standard deviations and correlation matrix in the $\mathbf{B \cdot T}$, $\mathbf{B \cdot R}$, T_L system for both estimating the physical constants and for ignoring them.

To present a better feeling for the effect of the various physical constants[e] on the miss parameter statistics, Fig. 35 shows the dispersion ellipses plotted in the **B** plane (*a priori* shown in Table 15). $GM_{☾}$ is not included since its effect is virtually eliminated due to the coordinate system (i.e. $\frac{\partial \mathbf{B}}{\partial GM_{☾}} \approx 0$); however, it does show itself in the third dimension T_L, which is not plotted. Obviously, the major contributor to the error is $GM_{\oplus}$. Therefore, if we are to obtain a higher degree of accuracy for future missions our estimates must be improved.

c. $GM_{\oplus}$ solution: no a priori. In the *Ranger 4* Report (Ref. 1) a solution for $GM_{\oplus}$ was obtained by perturbations and a quadratic curve fitting of the weighted sum of the residuals squared. These same *Ranger 4* data and

[e]The physical constants described in Ref. 6 were used in the trajectory calculation.

Table 16. Statistics of knowledge of injection conditions ignoring physical constant uncertainties

Standard deviation		Correlation coefficients					
		X	Y	Z	$\dot{X}$	$\dot{Y}$	$\dot{Z}$
		Space fixed cartesian coordinates					
X	0.0964 km	1	−0.544	−0.566	−0.510	−0.577	−0.314
Y	0.3678 km	Symmetrical	1	0.890	0.613	0.928	0.560
Z	0.6571 km			1	0.899	0.989	0.857
$\dot{X}$	0.7261 m/sec				1	0.846	0.966
$\dot{Y}$	0.3718 m/sec					1	0.814
$\dot{Z}$	0.9322 m/sec						1
		R	ϕ	λ	V	γ	σ
		Earth fixed spherical coordinates					
R	0.4281 km	1	−0.961	−0.909	−0.999	−0.934	0.852
ϕ	0.004498 deg	Symmetrical	1	0.860	0.952	0.846	−0.946
λ	0.003145 deg			1	0.916	0.952	0.675
V	0.3515 m/sec				1	0.942	−0.834
γ	0.002107 deg					1	−0.664
σ	0.006784 deg						1

also the *Ranger 3* and *Ranger 5* data have been processed through the new Orbit Determination Program (ODP) and the results are displayed in Table 19. Figure 36 summarizes the tracking coverage for each mission. Note that the old results on *Ranger 4* compare closely with these and that all the data tell approximately the same story. Although the estimates show a consistently lower value for $GM_{\oplus}$, they still have large standard deviations and are still within the nominal 1-*sigma* (± 4.0 km^3/sec^2) uncertainty. These statistics are, however, a direct function of our weighting scheme and since a conservative weight is assumed, possibly these standard deviations are conservative. The results are presented to show the consistency with the nominally accepted value and its uncertainty rather than to show any new value for $GM_{\oplus}$. When there is more assurance that other sources of error are absent in the data, possibly then a new value for $GM_{\oplus}$ may be derived.

Table 17. Comparison of parameter values

Parameters	Without physical constants	With physical constants	ΔQ (with–without)
X km	5807.2013	5807.2046	+0.0033
Y km	−1871.2780	−1871.2696	+0.0084
Z km	−2891.8163	−2891.7849	+0.0314
DX km/sec	3.6254421	3.6254794	$+0.0373 \times 10^{-3}$
DY km/sec	9.7646143	9.7646336	$+0.0196 \times 10^{-3}$
DZ km/sec	−2.8588116	−2.8587352	$+0.0764 \times 10^{-3}$
$GM_{\oplus}$ km³/sec²	398603.20 Nominal values	398600.05	−3
$GM_{☾}$ km³/sec²	4900.7589	4900.7604	+0.0015
DSIF 4			
radius, km	6372.6076	6372.6097	0.0021
latitude, deg	−31.2123	−31.2123	0.0000
longitude, deg	136.8862	136.8862	0.0000
DSIF 5			
radius, km	6375.4947	6375.4971	0.0024
latitude, deg	−25.7348	−25.7348	0.0000
longitude, deg	27.6848	27.6848	0.0000

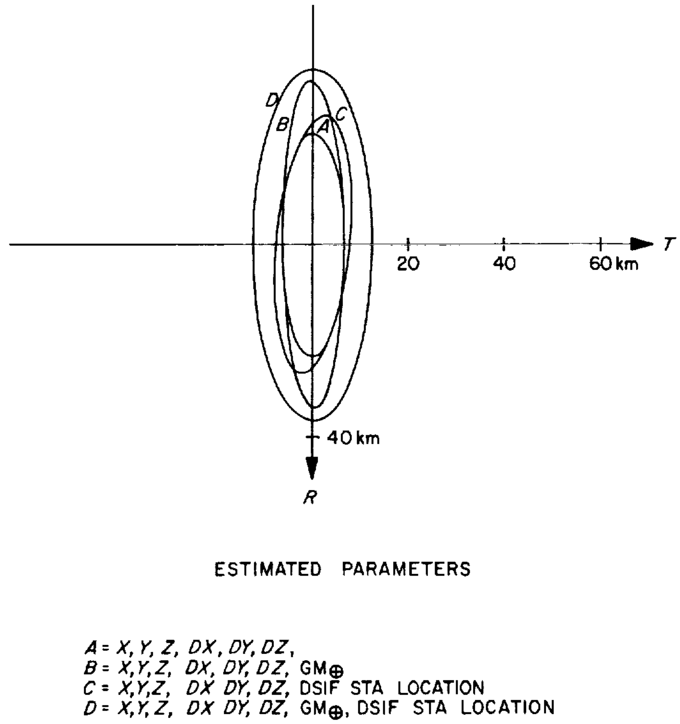

Fig. 35. Dispersion ellipses in the B plane for uncertainties in various estimated parameters

Table 18. Comparison of covariance matrices at encounter

Parameter	Without physical constants				With physical constants			
	Standard deviation	Correlation coefficients			Standard deviation	Correlation coefficients		
B • R	23.64 km	1	−0.030	0.623	36.75 km	1	−0.005	0.563
B • T	6.34 km		1	0.725	12.63 km		1	−0.178
T_L	4.29 sec	Symmetrical		1	7.19 sec	Symmetrical		1

Table 19. Estimates of $GM_{\oplus}$ using real tracking data

Item No.	Data from	$GM_{\oplus}$ [a] estimate, km³/sec²	Standard deviation on estimate, km³/sec²	Remarks
1	*Ranger 3*	398600.49	± 4.09	[b] Other parameters estimated in this same run are X, Y, Z, DX, DY, DZ, J, H, D and station locations
2	*Ranger 4*	398601.87 (398600.27)	±13.3 (±12.8)	Same as item No. 1[c] (Results in Ref. 1)
3	*Ranger 5*	398599.2	±13.2	Same as item No. 1

[a] Nominal $GM_{\oplus}$ = 398603.2 ±4.0.

[b] Although there was no *a priori* on the parameters X, Y, Z, DX, DY, DZ, $GM_{\oplus}$ in these solutions, there was *a priori* on J of 0.3×10^{-4}, H of 0.25×10^{-4}, D of 0.875×10^{-4}, station radius of 60 m, latitude of 0.001 deg and longitude of 0.001 deg.

[c] Occultation was not used as data but will be reported in the next technical report on *Ranger*.

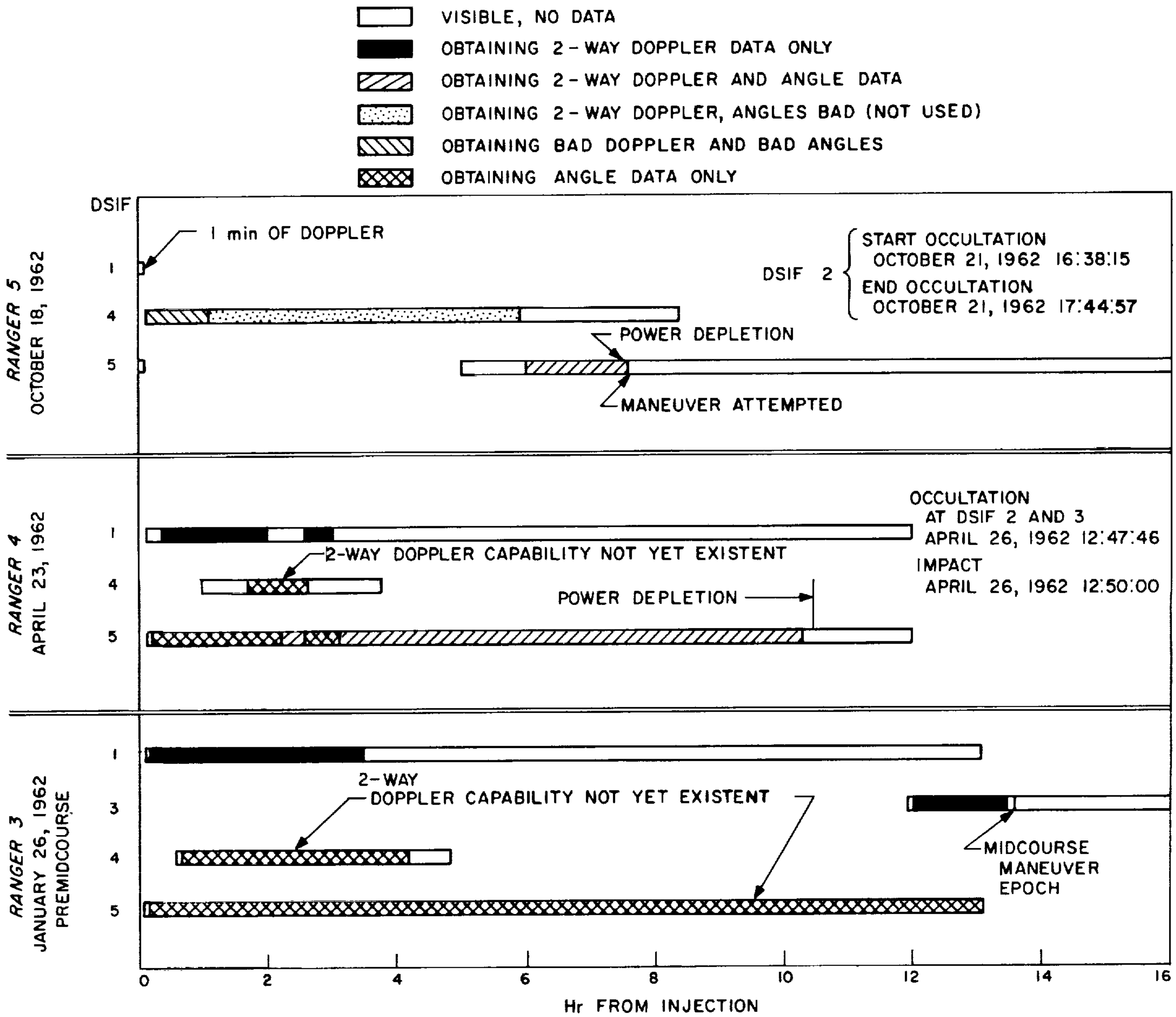

Fig. 36. Tracking station view periods for various *Ranger* missions and their data coverage

V. MIDCOURSE MANEUVER DETERMINATION USING DSIF CAPSULE BEACON TRACKING

A. Introduction

As soon as it was known that the batteries were being depleted on board the spacecraft and that soon there would be no power available to command a maneuver, commands were sent to place the probe on an impact trajectory. What response the spacecraft made to these commands was partially recorded by intermittent telemetry and the tracking data received from the capsule beacon. The spacecraft operated intermittently after battery failure, when solar power was high. Telemetry received some 10 hr after the command maneuver epoch indicated that the midcourse motor fuel was still intact and that the motor had not burned. It also showed that the attitude control gas, which was almost all available at the commanded maneuver time, was entirely consumed.

In the real time orbit determination it was assumed there was no maneuver and a predicted occultation was made on the early transponder data. There was a discrepancy of 8 min between the calculated and the observed time (calculated was 8 min early). Due to this inconsistency, a systematic study was made to determine whether there actually was some velocity increment added or whether the orbit determination program was wrong and no velocity increment had been added. Since the attitude control gas was completely expended and a known force could have been added, due to pitch jets not being coupled, it is possible that a small velocity increment occurred along the probe–Sun line.

B. Studies of Available Data

Although no single area investigated offered conclusive proof that a maneuver occurred, all study conclusions proposed that it did.

The studies included

1. Another independent program to check calculated occultation
2. A station compatibility test
3. Searches on occultation and beacon doppler peak for velocity increment
4. Comparing beacon doppler data (shape fitting) with varying models
5. Variation in our Earth-Moon model
6. Consistencies with *Ranger 3* and *Ranger 4* results
7. Angular data

In the actual operation when occultation time was first predicted it was computed for a hypothetical DSIF station located at the center of the Earth, but now a more elaborate program with actual station locations has confirmed the previous results. The agreement was within 30 sec and still indicated the same 8 min discrepancy.

A study of the various combinations of tracking data from each DSIF station showed that the 8 hr of transponder data were compatible and gave consistent results. Table 20 displays the effects on the impact parameters. The effects are small. Although DSIF 5 by itself tends to be somewhat different, especially in **B**·**R**, the differences are not significant, considering the error statistics. Occultation time is rather insensitive to changes in **B**·**R** in this range, and the change in **B**·**T** is in the wrong direction (i.e., correct occultation **B**·**T** = 5195).

Using the JPL trajectory program (Ref. 7), a search on the three velocity components (keeping position

Table 20. Station compatibility[a]

Data from DSIF[b] stations	B·T, km	B·R, km	Altitude, km	Time of closest approach	Remarks
1, 4, 5	5051	550	626	15:53:06	
1, 5	5064	574	637	15:53:06	
1, 4	5064	535	634	15:53:06	
4, 5	5061	473	628	15:52:52	
5	5001	72	565	15:53:29	Std. deviation ±1341 km on B
Searched in by occultation and doppler peak	5195	542	736	15:53:43	

[a] These results were obtained using a slightly different radius of Earth (*REM* = 6378.1650) scale factor on the lunar ephemeris than was used in the final orbit displayed in Appendix D.

[b] DSIF 1 and 4 by themselves had insufficient data to converge on an orbit. (Their angular data were not used.)

fixed) to satisfy the three times, start occultation, end occultation, and peak, in the beacon doppler data, was completed. The search was made at both the injection epoch and at the midcourse epoch. Comparing the results obtained with the results of the 8 hr of tracking data it can be seen that large changes are required at the injection epoch whereas at the midcourse epoch only a slight change will satisfy the end times (Table 21).

Table 21. Differences of searches at injection epoch and midcourse epoch with data orbit[a]

Parameters	Search at injection minus data orbit	Search at midcourse minus data orbit
DX	−6.63 m/sec	−0.64 m/sec
DY	+0.0047 m/sec	−0.24 m/sec
DZ	−9.33 m/sec	−0.067 m/sec

[a] Data orbit is the orbit obtained using the 8 hr of tracking data.

Table 15, which lists the standard deviations on the velocity components at injection, shows that better than a 5-*sigma* change would be required. If the errors are mapped to midcourse epoch, the change required at that epoch is still beyond the 1-*sigma*, as at injection (≈ 3 *sigma*); however, the magnitude of the departure is smaller and can be physically explained. Another discrediting fact about the injection epoch search is that when these conditions are used to pass a trajectory through the 8 hr of initial tracking, the residuals (actual observation—calculated observation) are greatly biased. This points, then, to an approximate 0.7 m/sec velocity increment at midcourse epoch in a direction 5 deg off the probe–Sun line and directed away from the Sun.

Next, the beacon doppler data near encounter were analyzed. Since there are some unknown constants in the calculations, such as the beacon frequency, the beacon frequency drift, and the reference oscillator bias at the receiving stations, an attempt to just match the shape of the doppler curve was made. Figure 37 shows the various calculated doppler compared to the observed doppler. Notice that the occultation searched in conditions match the observed data best. By putting in various drift rates on the beacon frequency, at times when the probe was in and out of the Moon's shadow, a slightly better fit is obtained (Fig. 37 curve No. 4).

A study of the variations of the physical constants in the model again cannot compensate for the 8 min variation in occultation. Figure 38 shows a cross plot for $GM_{\oplus}$, $GM_{☾}$, and REM[f] (the Earth–Moon distance scaling factor holding them in correct proportion) against occultation times and closest approach time. It is impossible to satisfy all the times by perturbing the physical constants. Even if the first occultation time were satisfied the change would be larger than 7- or 8-*sigma* on *REM*. The effect of uncertainty in ΔT [Universal Time (GMT) to Ephemeris Time] was negligible.

As further proof of the validity of the model, results from *Ranger 3* and *Ranger 4* missions were studied. *Ranger 3* flew by the Moon with a closest approach of some 35,000 km, and good tracking data were obtained before and after encounter. These data were very useful in the solution for $GM_{☾}$ and gave approximately the same value as the JPL nominal. *Ranger 4*, which was occulted by the Moon and definitely had no maneuver, had an orbit based upon about the same amount of tracking data as *Ranger 5*. The calculated occultation was off only 24 sec from the observed occultation and within 1-*sigma* uncertainty in the time of flight. This suggests that the model and trajectory program are correct.

There were some good angular data taken by DSIF 5 prior to and after occultation. Residuals shown in Fig. 39 are plotted from injection conditions at midcourse epoch and are based on no maneuver, the commanded maneuver, and the slight maneuver determined by occultation. The residuals definitely show that the commanded maneuver was not executed. They also show that the no-maneuver conditions deviate quite noticeably. However, the conditions determined by the occultation time, the reacquisition time, and the doppler peak time fit the real data fairly well, again supporting the belief that a small maneuver occurred.

C. Conclusions

All results seem to indicate a maneuver. Our best estimate of the magnitude and direction of this maneuver is a 0.69 m/sec velocity increment 5 deg off the probe–Sun line directed away from the Sun. The end conditions are displayed in Section II and in Appendix C of this Report. Although this small maneuver has an assumed epoch about the time of the commanded maneuver, there is a chance that the maneuver might have taken place several hours later when solar power was available. Possibly the maneuver took place slowly by means of the attitude control gas which was almost entirely available after the

[f] Does not affect the Earth's potential function.

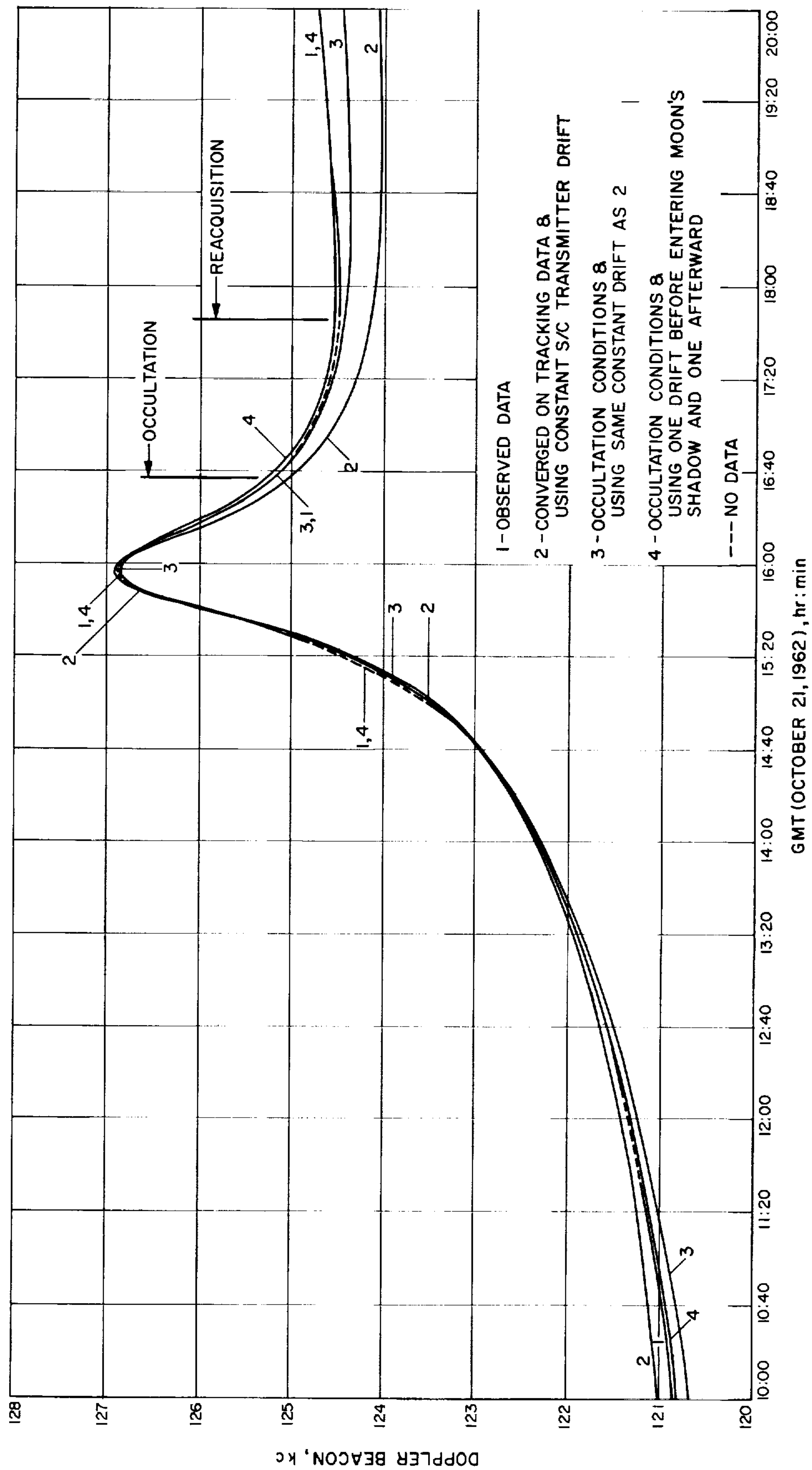

Fig. 37. Observed beacon data vs. calculated data

commanded, midcourse epoch (some 3+ pounds) and was depleted 10 hr later, as verified by telemetry recordings. Since there is not a perfect couple on the pitch jets, their contribution might have caused a velocity increment along the Sun line, as was indeed the case suggested by the occultation conditions.

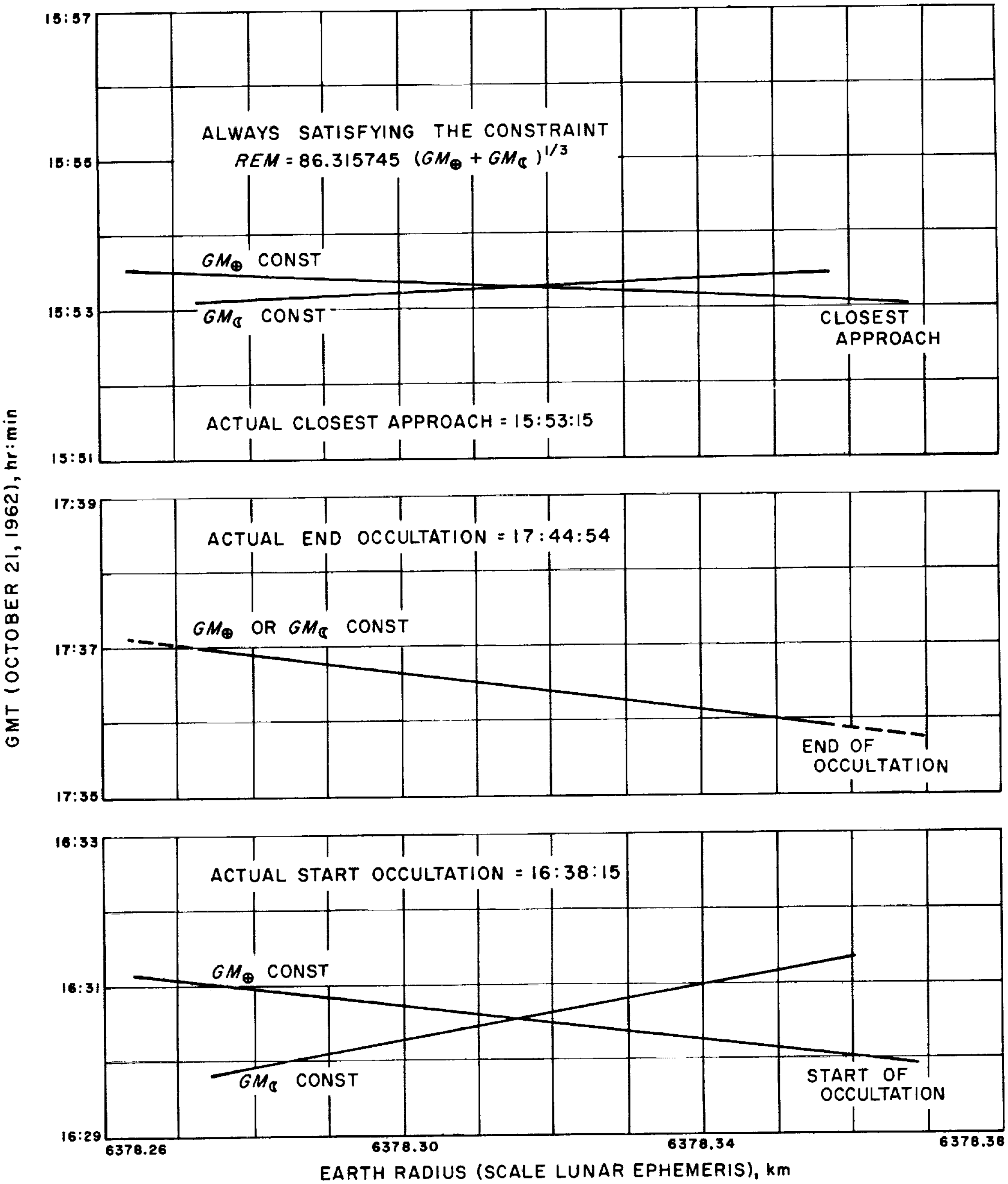

Fig. 38. Physical model study

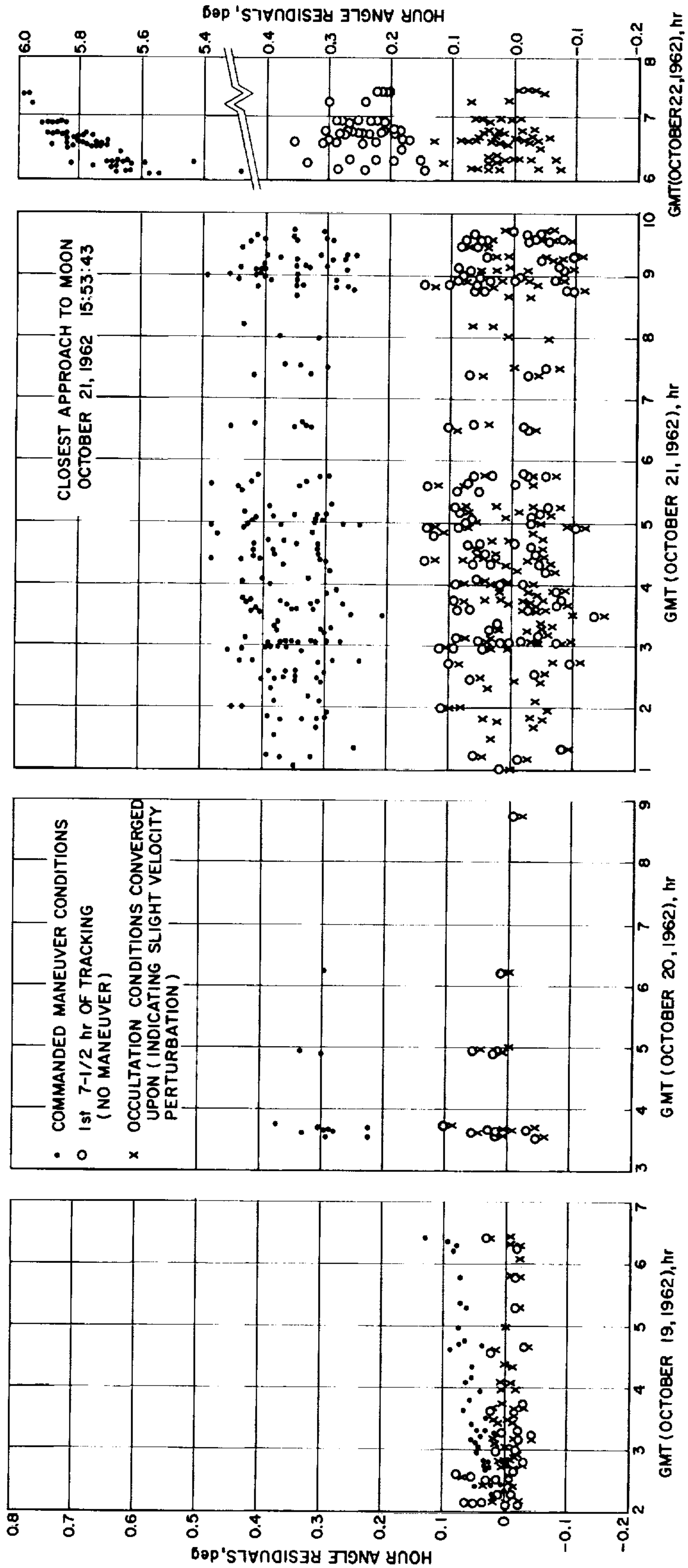

Fig. 39. Hour angle residuals DSIF 5

VI. FLIGHT PATH ANALYSIS OPERATIONS AND POLICIES

A. Introduction

The Flight Path Analysis group is the part of the spaceflight operations team which performs the real-time radio guidance calculations as well as the postflight determination of the spacecraft orbit. Its functions are depicted in Fig. 40.

It should be noted that the functions are sometimes carried on simultaneously in a single digital computer program.

B. Operational Description

1. Data Editing, Analysis, and Evaluation

Editing, analysis, and evaluation of the tracking data are accomplished in several ways.

a. Teletype (TTY) printed display of incoming data is visually scanned in real time to detect any systematic errors.

b. Station reports, both printed and verbal, are analyzed to detect any abnormalities. In addition, critical information on oscillator drift statistics, frequency changes and changes in transmitter assignment are evaluated.

c. Newly received TTY data are periodically entered, in batches, into a large digital computer program called the tracking data editing program (TDEP). The TDEP checks the format, data condition code, data range, station and time sequence against the input master format and control cards. All data are listed along with the reason for rejection of any data point. The new data which have not been rejected are added to the TDEP's master data tape, which contains all accepted data.

d. Once the orbit is reasonably well known, the deviations of the values of new observations from their predicted values (the residuals) are tested to determine whether they are within selected rejection limits. In this way "blunder points" are easily

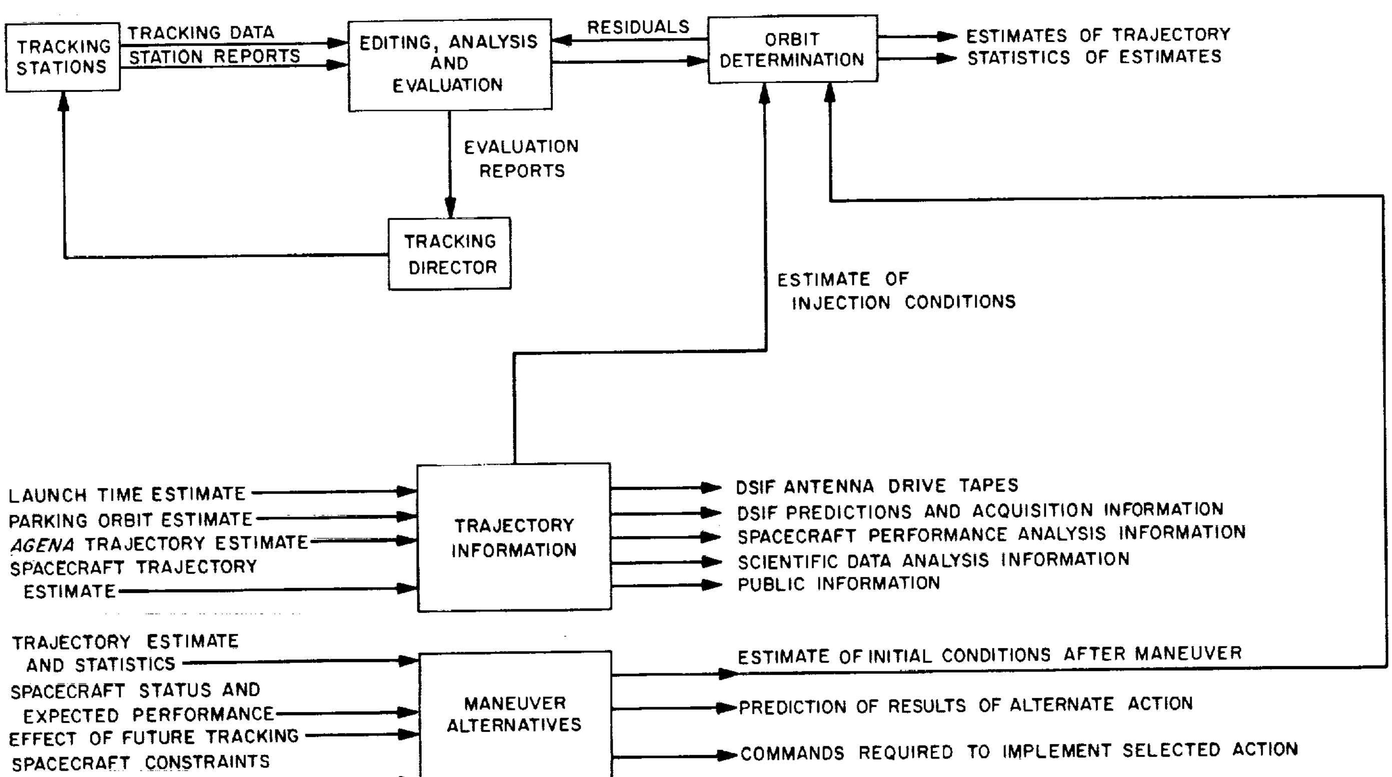

Fig. 40. Flight path analysis group functions

detected before they influence the estimate of the orbit.

e. The residuals and rejected data points are analyzed to determine the validity of the noise models and to locate any systematic error source. On the basis of the information gained from the evaluation of the incoming station reports and tracking data corrective action is recommended to the tracking director.

2. Orbit Determination

The tracking data placed on the TDEP's master data tape are the basis for forming an ODP data tape. Control of the information placed on the ODP data tape is exercised through input to the TDEP. The ODP and TDEP are linked in such a way that the ODP can call the TDEP to add new data to the ODP tape. The most important ODP inputs are the edited tracking data, the data weights, and rejection limits.

During the flight, new data points are continually being added to the ODP tape; weights are revised, and residuals from selected converged orbits are plotted and printed. The converged ODP output provides an estimate of the initial conditions and physical constants (parameters, in general) describing the flight path as well as a statistical description of the uncertainties in the parameter vector. The estimated covariance of the parameter vector is then mapped to other regions useful for interpretation of results. Typically, the properties of the "error ellipse" in the target plane (B-plane) are computed as well as other quantities useful in considering maneuver alternatives.

3. Trajectory Information

At all times information on a typical mission trajectory is essential to analysis of spacecraft performance and scientific data, supplying tracking station acquisition data, antenna pointing data, and general information. The basis for forming these trajectory estimates varies with the amount of information available and, thus, requires continual updating.

4. Maneuver Alternatives

As suggested in Fig. 40, the trajectory estimate(s), information on expected spacecraft performance and correct status, statistics of current and future knowledge of the flight path, spacecraft restraints, and mission objectives dependent on the flight path, are input into a digital computer program which is designed to examine the detailed results of following the available alternative maneuvers (trajectory) corrections. Commands necessary to implement any of the various alternate maneuvers are also computed and checked.

C. *In-flight Policies*

The JPL ODP is designed to find the set of initial conditions at injection epoch which causes the weighted sum of squares of the residuals (observed minus computed) to be minimized. The method is named modified-least-squares (MLS) to call attention to the method used in obtaining the weights. In the usual least squares method, the individual data points are weighted inversely proportional to their expected (or measured) variances to form the weighted sum of the squared residuals. In MLS, the independent weighting values are determined by the expected (or measured) effective variances.[8] In arriving at the effective variance for each data type at each DSIF station (vs. time) consideration is given to the effective correlation width of all recognized error sources, sampling rates, range to the spacecraft, counting time, and elevation angle. The ODP-calculated covariance matrix of injection errors will always give a conservative estimate of the accuracy when effective variances, "equivalent-or-worse uncorrelated noise," are used. In editing the data, the policy is that it is better to reject a data set with questionable format than to attempt the real-time correction of the error. An analogous policy is used in weighting the data; there is a maximum weight which can be assigned to any data point independent of whether it appears that the data may be dramatically better in a particular time interval or not. By sacrificing the possibility of extracting the maximum possible information during the flight the sensitivity to "blunder points" or small "hidden" errors, whose effect may be very significant, is reduced.

[8]This approach was first used at JPL by A. R. M. Noton in August, 1959 in an Internal Memorandum *Effect of Correlated Data in Orbit Determination from Radio Tracking Data.* Further discussion was given by A. R. M. Noton, E. Cutting, F. Barnes (Ref. 8). T. A. Magness and J. B. McGuire of Space Technology Laboratories, Inc., have developed mathematical expressions to contrast the performance of LS, MLS, and minimum covariance estimators (under JPL Contract No. 950045) in terms of the eigenvalues and eigen-vectors of the data noise covariance matrix (Ref. 9).

REFERENCES

1. Hamilton, T. W., W. L. Sjogren, W. E. Kirhofer, J. P. Fearey, and D. L. Cain, *The Ranger IV Flight Path and its Determination from Tracking Data,* Technical Report No. 32-345, Jet Propulsion Laboratory, Pasadena, September 15, 1962.

2. Jet Propulsion Laboratory, *Capability of the DSIF for Lunar Missions of Project Ranger—1961 through* Mid-1963, External Publication Document 48 (Rev. 1) Jet Propulsion Laboratory, Pasadena, April 20, 1962.

3. Jet Propulsion Laboratory, *Ranger 5 Tracking Information Memorandum* 332-16, External Publication Document III, Jet Propulsion Laboratory, Pasadena, September 20, 1962.

4. Wollenhaupt, W., *JPL Tracking System Data Analysis Report, Ranger 5* Preliminary Report, Jet Propulsion Laboratory, Pasadena, November 7, 1962.

5. Chaney, W. D., W. Wollenhaupt, *JPL Tracking System Data Analysis Report,* Monthly Summary Report, Jet Propulsion Laboratory, Pasadena, January 15, 1963.

6. Clarke, V. C. Jr., *Constants and Related Data Used in Trajectory Calculations at the Jet Propulsion Laboratory,* Technical Report No. 32-273, Jet Propulsion Laboratory, Pasadena, May 1, 1962.

7. Holdridge, D. B., *Space Trajectories Program for the IBM 7090 Computer,* Technical Report No. 32-223, Jet Propulsion Laboratory, Pasadena, March 2, 1962.

8. Noton, A. R. M., E. Cutting, and F. L. Barnes, *Analysis of Radio-Command Midcourse Guidance,* Technical Report No. 32-28, Jet Propulsion Laboratory, Pasadena, September 8, 1960.

9. Magness, T. A., and J. B. McGuire, "Comparison of Least Squares and Minimum Variance Estimates of Regression Parameters," *The Annals of Mathematical Statistics,* Vol. 33, No. 2, June 1962.

10. Kizner, W., *A Method of Describing Miss Distances for Lunar and Interplanetary Trajectories,* External Publication No. 674, Jet Propulsion Laboratory, Pasadena, August 1, 1959.

11. Hudson, R. H., M. W. Nead, and M. R. Warner, *The Orbit Determination Program of the Jet Propulsion Laboratory,* Technical Memorandum No. 33-168, Jet Propulsion Laboratory, Pasadena, March 18, 1964.

APPENDIX A

Definition of the miss parameter B

The miss parameter **B** is used at JPL to measure miss distances for lunar and interplanetary trajectories and is described by W. Kizner in Ref. 10. **B** has the desirable feature of being very nearly a linear function of changes in injection conditions.

The osculating conic at closest approach to the target body is used in defining **B**. **B** is the vector from the target's center of mass perpendicular to the incoming asymptote. Let $\mathbf{S}_I$ be a unit vector in the direction of the incoming asymptote. The orientation of **B** in the plane normal to S_I is described in terms of two unit vectors **R** and **T**, normal to $\mathbf{S}_I$. **T** is taken parallel to a fixed *reference plane* and **R** completes a right-handed orthogonal system. Figure A-1 illustrates the situation.

The *Ranger 5* work has used the orbital plane of the Moon as the reference plane. If **W** is a unit vector normal to the orbital plane (**W** in direction of $\mathbf{R}_M \times \mathbf{V}_M$, where $\mathbf{R}_M$ is radius vector to Moon from Earth and $\mathbf{V}_M$ is the space-fixed velocity of the Moon relative to the Earth's center) then $\mathbf{T} = \mathbf{S}_I \times \mathbf{W}$ defines our coordinate system.

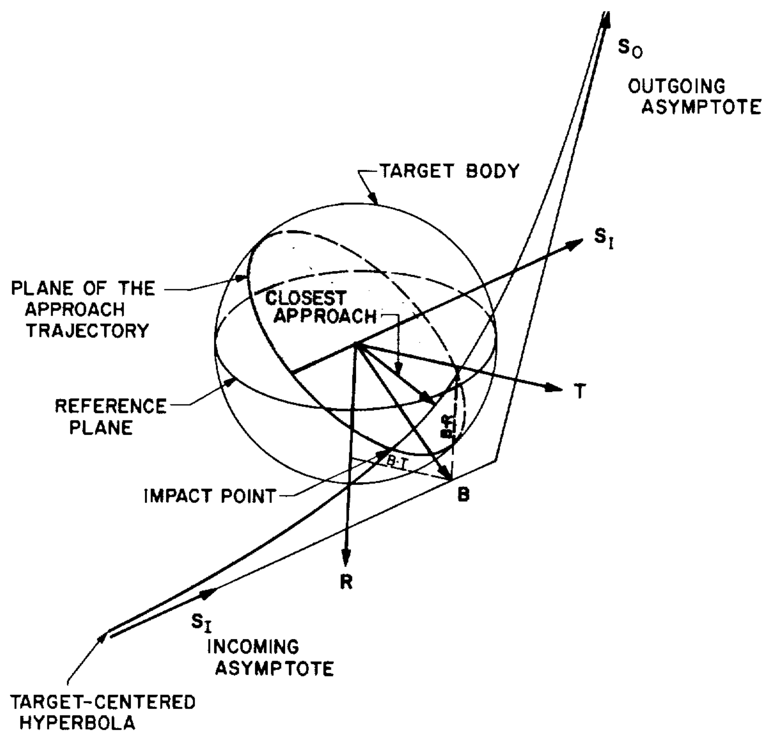

Fig. A-1. Definition of B·T, B·R system

APPENDIX B

Ranger 5 premidcourse orbit

```
CASE  1                                        SPACE TRAJECTORIES                                                   1

                                              RA-5 PREMIDCOURSE ORBIT
   EPHEMERIDES WITH VENUS VELOCITIES

  GME  .39860005 06     J  .16234500-02      H -.57499999-05      D  .78749999-05     RE  .63781650 04    REM  .63783149 04
    G  .66709998-19     A  .88745998 29      B  .88763998 29      C  .88800998 29    OME  .41780741-02     AU  .14959900 09
  GMM  .49007604 04   GMS  .13271544 12    GMV  .32476950 06    GMA  .42977799 05    GMC  .00000000 00    GMJ  .12671060 09

INJECTION CONDITIONS          MOON               JULIAN DATE 2437956.23429397               OCT. 18,1962   17 37 23.000

GEOCENTRIC       XO .58072045 04  YO-.18712696 04  ZO-.28917849 04 DXO .36254793 01 DYO .97646335 01 DZO-.28587352 01
CARTESIAN       GMC .00000000 00 SGC .00000000 00  TO .63443000 05 GHA .29107121 03 GHO .26001651 02

   0 DAYS   0 HRS.   0 MIN.   0.000 SEC.         JULIAN DATE 2437956.23429397               OCT. 18,1962   17 37 23.000

GEOCENTRIC                                                                                         EQUATORIAL COORDINATES

    X  .58072042 04     Y -.18712695 04      Z -.28917848 04     DX  .36254792 01     DY  .97646330 01     DZ -.28587350 01
    R  .67518656 04   DEC -.25359354 02     RA  .34213937 03      V  .10801135 02    PTH  .87138015 01     AZ  .10292466 03
    R  .67518656 04   LAT -.25359354 02    LON  .51068163 02     VE  .10373187 02    PTE  .90762677 01    AZE  .10348129 03
   XS -.13520355 09    YS -.57485767 08     ZS -.24927463 08    DXS  .12999476 02    DYS -.24699600 02    DZS -.10709378 02
   XM -.35387210 05    YM  .35420188 06     ZM  .13533405 06    DXM -.10263041 01    DYM -.47486097-01    DZM  .61074614-01
   XT -.35387210 05    YT  .35420188 06     ZT  .13533405 06    DXT -.10263041 01    DYT -.47486097-01    DZT  .61074614-01
   RS  .14901675 09    VS  .29895608 02     RM  .38082349 06     VM  .10292157 01     RT  .38082349 06     VT  .10292157 01
  GED -.25510281 02   ALT  .37762024 03    LOS  .27196298 03    RAS  .20303420 03    RAM  .95705310 02    LOM  .16463410 03
  DUT  .34000000 02    DT  .15000000 02     DR  .16363602 01    SHA  .53923425 04    DES -.96296871 01    DEM  .20816252 02

GEOCENTRIC                                             CONIC        ORBITAL B.T AND B.R        EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE                      JULIAN DATE 2437956.23211020               OCT. 18,1962   17 34 14.322
  SMA  .28338638 06   ECC  .97672770 00    INC  .28267556 02    LAN  .10032216 03    APF  .22709996 03    RCA  .65950505 04
   VH  .12868423 00    C3 -.14065603 01     CI  .72086038 05    SLR  .13036619 05    APO  .56017771 06    TFP  .18867777 03
   TA  .17636897 02    EA  .19287510 01     MA  .45242184-01    DAO -.20299316 02    RAD  .32378684 03    MTA  .18000000 03
   WX  .46592490 00    WY  .84859047-01     WZ  .88074566 00     PX  .75671531 00     PY -.55409867 00     PZ -.34692447 00
   QX  .45858032 00    QY  .82811447 00     QZ -.32238250 00     RX -.74409175-01     RY  .45422299 00     RZ -.88777514 00
  SXO  .75671531 00   SYO -.55409867 00    SZO -.34692447 00     TX -.64949612 00     TY -.69760743 00     TZ -.30248748 00
   BX -.45858033 00    BY -.82811449 00     BZ  .32238251 00     MX  .20775271 00     MY  .95707242 00     MZ -.20211671 00
  B.T  .47289794 05   B.R -.38184770 05      B  .60781588 05    PER  .25022369 05    OMD  .11568786-01    NOD -.70793328-02
  C3J -.17673254 01

HELIOCENTRIC                                                                                          ECLIPTIC COORDINATES

    X  .13520936 09     Y  .62654867 08      Z -.16777500 04     DX -.93739973 01     DY  .34742733 02     DZ -.65083368 01
    R  .14902082 09   LAT -.64506418-03    LON  .24862606 02      V  .36568945 02    PTH  .96058455 01     AZ  .10039908 03
   XE  .13520355 09    YE  .62657735 08     ZE  .23125000 03    DXE -.12999476 02    DYE  .26921386 02    DZE -.88334083-03
   XT  .13516816 09    YT  .63036539 08     ZT -.16518250 05    DXT -.14025781 02    DYT  .26902116 02    DZT  .74041723-01
  LTE  .88913819-04   LOE  .24864544 02    LTT -.63457043-02    LOT  .25002294 02    RST  .14914435 09    VST  .30338950 02
  EPS  .52998810 02   ESP  .98911702-02    SEP  .12699911 03    EPM  .59788097 02    EMP  .87787433 00    MEP  .11933401 03
  MPS  .10868800 03   MSP  .13970734 00    SMP  .71172195 02    SEM  .10950792 03    EMS  .70354181 02    ESM  .13776809 00
  EPT  .59788097 02   ETP  .87787433 00    TEP  .11933401 03    TPS  .10868800 03    TSP  .13970734 00    STP  .71172195 02
  SET  .10950792 03   STE  .70354181 02    EST  .13776809 00    RPM  .38417632 06    RPT  .38417632 06    SPN -.17845042 02
  GCE  .26321723 03   GCT  .28628363 03    SIP  .10842879 03    CPT  .73767244 02    SIN  .73508038 02     D1  .13572032 00
  REP  .67518656 04   VEP  .10801135 02    CPE  .96943128 02    CPS  .92538460 02     D2  .43988254-01     D3  .20935527-03

   0 DAYS   0 HRS.  10 MIN.   0.000 SEC.         JULIAN DATE 2437956.24123842               OCT. 18,1962   17 47 23.000
```

CASE 1

SPACE TRAJECTORIES 2

RA-5 PREMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	.67941044 04	Y	.40122196 04	Z	-.39791851 04	DX	.54344019-01	DY	.93768808 01	DZ	-.92790306 00
R	.88369493 04	DEC	-.26762257 02	RA	.30563730 02	V	.94228366 01	PTH	.30038984 02	AZ	.80547961 02
R	.88369492 04	LAT	-.26762258 02	LON	.96985676 02	VE	.89365234 01	PTE	.31858986 02	AZE	.79834681 02
XS	-.13519575 09	YS	-.57500585 08	ZS	-.24933889 08	DXS	.13002732 02	DYS	-.24698235 02	DZS	-.10708785 02
XM	-.36002943 05	YM	.35417292 06	ZM	.13537052 06	DXM	-.10261384 01	DYM	-.49043410-01	DZM	.60479669-01
XT	-.36002943 05	YT	.35417292 06	ZT	.13537052 06	DXT	-.10261384 01	DYT	-.49043410-01	DZT	.60479669-01
RS	.14901647 09	VS	.29895684 02	RM	.38086722 06	VM	.10290885 01	RT	.38086722 06	VT	.10290885 01
GED	-.26919026 02	ALT	.24631213 04	LOS	.26946264 03	RAS	.20304070 03	RAM	.95804380 02	LOM	.16222632 03
DUT	.34000000 02	DT	.59999999 02	DR	.47169696 01	SHA	.53329729 04	DES	-.96322126 01	DEM	.20819619 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13520255 09	Y	.62675984 08	Z	-.50160000 04	DX	-.12948388 02	DY	.35153645 02	DZ	-.45826195 01
R	.14902352 09	LAT	-.19285253-02	LON	.24871073 02	V	.37741752 02	PTH	.46162055 01	AZ	.96996738 02
XE	.13519575 09	YE	.62673886 08	ZE	.23100000 03	DXE	-.13002732 02	DYE	.26919898 02	DZE	-.88405608-03
XT	.13515975 09	YT	.63052680 08	ZT	-.16473500 05	DXT	-.14028870 02	DYT	.26898963 02	DZT	.74114441-01
LTE	.88817866-04	LOE	.24871439 02	LTT	-.63285471-02	LOT	.25009280 02	RST	.14914355 09	VST	.30337582 02
EPS	.37117903 02	ESP	.27453512-18	SEP	.14288004 03	EPM	.99611839 02	EMP	.13108232 01	MEP	.79077321 02
MPS	.10838076 03	MSP	.13829968 00	SMP	.71480963 02	SEM	.10942253 03	EMS	.70439477 02	ESM	.13776809 00
EPT	.99611839 02	ETP	.13108232 01	TEP	.79077321 02	TPS	.10838076 03	TSP	.13829968 00	STP	.71480963 02
SET	.10942253 03	STE	.70439477 02	EST	.13776809 00	RPM	.37929202 06	RPT	.37929202 06	SPN	-.90806103 01
GCE	.20425205 03	GCT	.28576981 03	SIP	.10811821 03	CPT	.74238230 02	SIN	.73975686 02	D1	.13746808 00
REP	.88369493 04	VEP	.94228366 01	CPE	.12580451 03	CPS	.92541746 02	D2	.43852657-01	D3	.21099964-03

0 DAYS 0 HRS. 20 MIN. 0.000 SEC. JULIAN DATE 2437956.24818286 OCT. 18,1962 17 57 23.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.63034878 04	Y	.92056969 04	Z	-.42171780 04	DX	-.14482836 01	DY	.79570248 01	DZ	.44149064-02
R	.11927422 05	DEC	-.20705824 02	RA	.55599086 02	V	.80877554 01	PTH	.41644290 02	AZ	.70312225 02
R	.11927422 05	LAT	-.20705825 02	LON	.11951418 03	VE	.75375228 01	PTE	.45480533 02	AZE	.67339381 02
XS	-.13518795 09	YS	-.57515404 08	ZS	-.24940314 08	DXS	.13005987 02	DYS	-.24696871 02	DZS	-.10708192 02
XM	-.36618576 05	YM	.35414303 06	ZM	.13540663 06	DXM	-.10259702 01	DYM	-.50600073-01	DZM	.59884761-01
XT	-.36618576 05	YT	.35414303 06	ZT	.13540663 06	DXT	-.10259702 01	DYT	-.50600073-01	DZT	.59884761-01
RS	.14901618 09	VS	.29895760 02	RM	.38091096 06	VM	.10289613 01	RT	.38091096 06	VT	.10289613 01
GED	-.20834852 02	ALT	.55519149 04	LOS	.26696231 03	RAS	.20304721 03	RAM	.95903432 02	LOM	.15981853 03
DUT	.34000000 02	DT	.12000000 03	DR	.53743464 01	SHA	.82999985 04	DES	-.96347364 01	DEM	.20822929 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13519425 09	Y	.62696806 08	Z	-.73010000 04	DX	-.14454271 02	DY	.34220404 02	DZ	-.31623937 01
R	.14902475 09	LAT	-.28070268-02	LON	.24879677 02	V	.37282204 02	PTH	.19741825 01	AZ	.94868652 02
XE	.13518795 09	YE	.62690039 08	ZE	.23050000 03	DXE	-.13005987 02	DYE	.26918410 02	DZE	-.88536739-03
XT	.13515133 09	YT	.63068819 08	ZT	-.16429250 05	DXT	-.14031957 02	DYT	.26895810 02	DZT	.74186801-01
LTE	.88625788-04	LOE	.24878336 02	LTT	-.63115819-02	LOT	.25016266 02	RST	.14914274 09	VST	.30336215 02
EPS	.44093813 02	ESP	.27453512-18	SEP	.13590299 03	EPM	.12122267 03	EMP	.15344371 01	MEP	.57242905 02
MPS	.10829255 03	MSP	.13651968 00	SMP	.71570814 02	SEM	.10933717 03	EMS	.70524751 02	ESM	.13812271 00
EPT	.12122267 03	ETP	.15344371 01	TEP	.57242905 02	TPS	.10829255 03	TSP	.13651968 00	STP	.71570814 02
SET	.10933717 03	STE	.70524751 02	EST	.13812271 00	RPM	.37459160 06	RPT	.37459160 06	SPN	.11767929 02
GCE	.16909444 03	GCT	.28541568 03	SIP	.10802671 03	CPT	.74569248 02	SIN	.74303409 02	D1	.13919309 00
REP	.11927422 05	VEP	.80877554 01	CPE	.13560075 03	CPS	.92544673 02	D2	.44197509-01	D3	.21520243-03

0 DAYS 0 HRS. 40 MIN. 0.000 SEC. JULIAN DATE 2437956.26207176 OCT. 18,1962 18 17 23.000

CASE 1 SPACE TRAJECTORIES 3

RA-5 PREMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	.39342783 04	Y	.17483859 05	Z	-.37558585 04	DX	-.22706322 01	DY	.60468681 01	DZ	.62289629 00
R	.18310388 05	DEC	-.11836625 02	RA	.77318336 02	V	.64890973 01	PTH	.52646949 02	AZ	.64136273 02
R	.18310388 05	LAT	-.11836625 02	LON	.13621975 03	VE	.58784962 01	PTE	.61339827 02	AZE	.52470751 02
XS	-.13517234 09	YS	-.57545041 08	ZS	-.24953163 08	DXS	.13012497 02	DYS	-.24694140 02	DZS	-.10707006 02
XM	-.37849539 05	YM	.35408044 06	ZM	.13547778 06	DXM	-.10256258 01	DYM	-.53711440-01	DZM	.58695064-01
XT	-.37849539 05	YT	.35408044 06	ZT	.13547778 06	DXT	-.10256258 01	DYT	-.53711440-01	DZT	.58695064-01
RS	.14901561 09	VS	.29895912 02	RM	.38099839 06	VM	.10287071 01	RT	.38099839 06	VT	.10287071 01
GED	-.11914991 02	ALT	.11933090 05	LOS	.26196164 03	RAS	.20306023 03	RAM	.96101479 02	LOM	.15500289 03
DUT	.34000000 02	DT	.12000000 03	DR	.51582617 01	SHA	.15535248 05	DES	-.96397848 01	DEM	.20829375 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13517627 09	Y	.62736886 08	Z	-.10172250 05	DX	-.15283130 02	DY	.32710989 02	DZ	-.18350434 01
R	.14902530 09	LAT	-.39109262-02	LON	.24896565 02	V	.36151767 02	PTH	-.14582881 00	AZ	.92909572 02
XE	.13517234 09	YE	.62722340 08	ZE	.22925000 03	DXE	-.13012497 02	DYE	.26915432 02	DZE	-.88715553-03
XT	.13513449 09	YT	.63101090 08	ZT	-.16339750 05	DXT	-.14038123 02	DYT	.26889504 02	DZT	.74331283-01
LTE	.88145509-04	LOE	.24892129 02	LTT	-.62772667-02	LOT	.25030237 02	RST	.14914113 09	VST	.30333478 02
EPS	.58036312 02	ESP	.27453512-18	SEP	.12195771 03	EPM	.14073445 03	EMP	.17430615 01	MEP	.37522495 02
MPS	.10834923 03	MSP	.13362238 00	SMP	.71517070 02	SEM	.10916650 03	EMS	.70695239 02	ESM	.13812271 00
EPT	.14073445 03	ETP	.17430615 01	TEP	.37522495 02	TPS	.10834923 03	TSP	.13362238 00	STP	.71517070 02
SET	.10916650 03	STE	.70695239 02	EST	.13812271 00	RPM	.36664581 06	RPT	.36664581 06	SPN	.37651302 02
GCE	.14597694 03	GCT	.28495947 03	SIP	.10807763 03	CPT	.75002703 02	SIN	.74731103 02	D1	.14220968 00
REP	.18310388 05	VEP	.64890973 01	CPE	.13655260 03	CPS	.92549813 02	D2	.45286705-01	D3	.22533403-03

0 DAYS 1 HRS. 10 MIN. 0.000 SEC. JULIAN DATE 2437956.28290509 OCT. 18,1962 18 47 23.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.34975021 03	Y	.26943470 05	Z	-.23939768 04	DX	-.24165863 01	DY	.46368705 01	DZ	.83518024 00
R	.27051876 05	DEC	-.50770759 01	RA	.90743706 02	V	.52950905 01	PTH	.59782995 02	AZ	.62148529 02
R	.27051875 05	LAT	-.50770759 01	LON	.14212458 03	VE	.47580899 01	PTE	.74081145 02	AZE	.17447221 02
XS	-.13514891 09	YS	-.57589489 08	ZS	-.24972436 08	DXS	.13022262 02	DYS	-.24690039 02	DZS	-.10705225 02
XM	-.39695194 05	YM	.35397957 06	ZM	.13558182 06	DXM	-.10250896 01	DYM	-.58373524-01	DZM	.56910842-01
XT	-.39695194 05	YT	.35397957 06	ZT	.13558182 06	DXT	-.10250896 01	DYT	-.58373524-01	DZT	.56910842-01
RS	.14901476 09	VS	.29896140 02	RM	.38112946 06	VM	.10283263 01	RT	.38112946 06	VT	.10283263 01
GED	-.51114924 01	ALT	.20673839 05	LOS	.25446064 03	RAS	.20307976 03	RAM	.96398405 02	LOM	.14777928 03
DUT	.34000000 02	DT	.24000000 03	DR	.45756227 01	SHA	.25255150 05	DES	-.96473569 01	DEM	.20838614 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13514856 09	Y	.62794554 08	Z	-.12687500 05	DX	-.15438848 02	DY	.31497359 02	DZ	-.10793421 01
R	.14902446 09	LAT	-.48779925-02	LON	.24921162 02	V	.35094253 02	PTH	-.11905216 01	AZ	.91762923 02
XE	.13514891 09	YE	.62770787 08	ZE	.22775000 03	DXE	-.13022262 02	DYE	.26910962 02	DZE	-.88977813-03
XT	.13510921 09	YT	.63149488 08	ZT	-.16206000 05	DXT	-.14047352 02	DYT	.26880047 02	DZT	.74546336-01
LTE	.87569266-04	LOE	.24912817 02	LTT	-.62259845-02	LOT	.25051192 02	RST	.14913872 09	VST	.30329368 02
EPS	.68990573 02	ESP	.13988227-01	SEP	.11099972 03	EPM	.15155948 03	EMP	.19371461 01	MEP	.26503374 02
MPS	.10859468 03	MSP	.13009806 00	SMP	.71275275 02	SEM	.10891067 03	EMS	.70950808 02	ESM	.13865293 00
EPT	.15155948 03	ETP	.19371461 01	TEP	.26503374 02	TPS	.10859468 03	TSP	.13009806 00	STP	.71275275 02
SET	.10891067 03	STE	.70950808 02	EST	.13865293 00	RPM	.35712461 06	RPT	.35712461 06	SPN	.55353603 02
GCE	.13470099 03	GCT	.28453812 03	SIP	.10831584 03	CPT	.75409591 02	SIN	.75130751 02	D1	.14600119 00
REP	.27051876 05	VEP	.52950905 01	CPE	.13222043 03	CPS	.92556679 02	D2	.47086019-01	D3	.24084798-03

0 DAYS 1 HRS. 30 MIN. 0.000 SEC. JULIAN DATE 2437956.29679397 OCT. 18,1962 19 07 23.000

CASE 1

SPACE TRAJECTORIES

4

RA-5 PREMIDCOURSE ORBIT

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.32347965 04	Y	.32162287 05	Z	-.13665520 04	DX	-.23857680 01	DY	.40937055 01	DZ	.87087224 00
R	.32353424 05	DEC	-.24207923 01	RA	.95743340 02	V	.48175441 01	PTH	.62450051 02	AZ	.61821122 02
R	.32353424 05	LAT	-.24207923 01	LON	.14211052 03	VE	.44164927 01	PTE	.75266389 02	AZE	.33951868 03
XS	-.13513328 09	YS	-.57619115 08	ZS	-.24985281 08	DXS	.13028771 02	DYS	-.24687304 02	DZS	-.10704037 02
XM	-.40925081 05	YM	.35390766 06	ZM	.13564940 06	DXM	-.10247191 01	DYM	-.61478211-01	DZM	.55721606-01
XT	-.40925081 05	YT	.35390766 06	ZT	.13564940 06	DXT	-.10247191 01	DYT	-.61478211-01	DZT	.55721606-01
RS	.14901419 09	VS	.29896292 02	RM	.38121679 06	VM	.10280728 01	RT	.38121679 06	VT	.10280728 01
GED	-.24372697 01	ALT	.25975256 05	LOS	.24945997 03	RAS	.20309278 03	RAM	.96596256 02	LOM	.14296344 03
DUT	.34000000 02	DT	.24000000 03	DR	.42712730 01	SHA	.30995893 05	DES	-.96524044 01	DEM	.20844487 02

HELIOCENTRIC | ECLIPTIC COORDINATES

X	.13513004 09	Y	.62832042 08	Z	-.13822500 05	DX	-.15414539 02	DY	.31010244 02	DZ	-.83050966 00
R	.14902347 09	LAT	-.53144038-02	LON	.24937233 02	V	.34640049 02	PTH	-.14932117 01	AZ	.91374427 02
XE	.13513328 09	YE	.62803078 08	ZE	.22650000 03	DXE	-.13028771 02	DYE	.26907980 02	DZE	-.89156627-03
XT	.13509235 09	YT	.63181739 08	ZT	-.16116500 05	DXT	-.14053490 02	DYT	.26873744 02	DZT	.74688553-01
LTE	.87088978-04	LOE	.24926611 02	LTT	-.61916678-02	LOT	.25065161 02	RST	.14913710 09	VST	.30326626 02
EPS	.73331618 02	ESP	.13988227-01	SEP	.10665646 03	EPM	.15463629 03	EMP	.20833981 01	MEP	.23280281 02
MPS	.10878527 03	MSP	.12782211 00	SMP	.71086792 02	SEM	.10874023 03	EMS	.71121079 02	ESM	.13865293 00
EPT	.15463629 03	ETP	.20833981 01	TEP	.23280281 02	TPS	.10878527 03	TSP	.12782211 00	STP	.71086792 02
SET	.10874023 03	STE	.71121079 02	EST	.13865293 00	RPM	.35173002 06	RPT	.35173002 06	SPN	.61962132 02
GCE	.13089602 03	GCT	.28433643 03	SIP	.10850216 03	CPT	.75606513 02	SIN	.75323395 02	D1	.14824051 00
REP	.32353424 05	VEP	.48175441 01	CPE	.12974477 03	CPS	.92560976 02	D2	.48275089-01	D3	.25098231-03

0 DAYS 3 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437956.35929397 OCT. 18,1962 20 37 23.000

GEOCENTRIC | EQUATORIAL COORDINATES

X	-.15458624 05	Y	.50451653 05	Z	.33526115 04	DX	-.21422580 01	DY	.28845730 01	DZ	.85775936 00
R	.52873228 05	DEC	.36354774 01	RA	.10703531 03	V	.36940197 01	PTH	.68339917 02	AZ	.61940436 02
R	.52873228 05	LAT	.36354774 01	LON	.13084089 03	VE	.43808802 01	PTE	.51598263 02	AZE	.28363184 03
XS	-.13506284 09	YS	-.57752403 08	ZS	-.25043072 08	DXS	.13058055 02	DYS	-.24674976 02	DZS	-.10698683 02
XM	-.46453837 05	YM	.35353801 06	ZM	.13593585 06	DXM	-.10229231 01	DYM	-.75415304-01	DZM	.50372698-01
XT	-.46453837 05	YT	.35353801 06	ZT	.13593585 06	DXT	-.10229231 01	DYT	-.75415304-01	DZT	.50372698-01
RS	.14901163 09	VS	.29896975 02	RM	.38160927 06	VM	.10269355 01	RT	.38160927 06	VT	.10269355 01
GED	.36601853 01	ALT	.46495109 05	LOS	.22695696 03	RAS	.20315138 03	RAM	.97485611 02	LOM	.12129119 03
DUT	.34000000 02	DT	.48000000 03	DR	.34331848 01	SHA	.52519540 05	DES	-.96751130 01	DEM	.20868073 02

HELIOCENTRIC | ECLIPTIC COORDINATES

X	.13504738 09	Y	.62995975 08	Z	-.16774250 05	DX	-.15200313 02	DY	.29882259 02	DZ	-.36151600 00
R	.14901774 09	LAT	-.64495253-02	LON	.25007788 02	V	.33528042 02	PTH	-.19532625 01	AZ	.90618380 02
XE	.13506284 09	YE	.62948355 08	ZE	.22125000 03	DXE	-.13058055 02	DYE	.26894540 02	DZE	-.89907645-03
XT	.13501638 09	YT	.63326791 08	ZT	-.15712000 05	DXT	-.14080978 02	DYT	.26845389 02	DZT	.75318336-01
LTE	.85071821-04	LOE	.24988681 02	LTT	-.60365606-02	LOT	.25128006 02	RST	.14912983 09	VST	.30314263 02
EPS	.83348911 02	ESP	.20982341-01	SEP	.96630894 02	EPM	.15736557 03	EMP	.30565740 01	MEP	.19577839 02
MPS	.10965504 03	MSP	.12033130 00	SMP	.70224735 02	SEM	.10797428 03	EMS	.71886258 02	ESM	.13918114 00
EPT	.15736557 03	ETP	.30565740 01	TEP	.19577839 02	TPS	.10965504 03	TSP	.12033130 00	STP	.70224735 02
SET	.10797428 03	STE	.71886258 02	EST	.13918114 00	RPM	.33226549 06	RPT	.33226549 06	SPN	.76420553 02
GCE	.12282131 03	GCT	.28374364 03	SIP	.10935534 03	CPT	.76193453 02	SIN	.75893750 02	D1	.15692485 00
REP	.52873228 05	VEP	.36940197 01	CPE	.12289079 03	CPS	.92579076 02	D2	.53354553-01	D3	.29512287-03

0 DAYS 5 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437956.44262731 OCT. 18,1962 22 37 23.000

RA-5 PREMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.29937079 05	Y	.68526171 05	Z	.92859943 04	DX	-.18961275 01	DY	.22195830 01	DZ	.79120096 00
R	.75354458 05	DEC	.70786031 01	RA	.11359911 03	V	.30245408 01	PTH	.71560451 02	AZ	.62551400 02
R	.75354458 05	LAT	.70786031 01	LON	.10732255 03	VE	.54428481 01	PTE	.31813802 02	AZE	.27547114 03
XS	-.13496867 09	YS	-.57930014 08	ZS	-.25120081 08	DXS	.13097084 02	DYS	-.24658494 02	DZS	-.10691524 02
XM	-.53809346 05	YM	.35292838 06	ZM	.13627288 06	DXM	-.10202031 01	DYM	-.93907969-01	DZM	.43249133-01
XT	-.53809346 05	YT	.35292838 06	ZT	.13627288 06	DXT	-.10202031 01	DYT	-.93907969-01	DZT	.43249133-01
RS	.14900821 09	VS	.29897886 02	RM	.38213110 06	VM	.10254285 01	RT	.38213110 06	VT	.10254285 01
GED	.71263479 01	ALT	.68976580 05	LOS	.19695297 03	RAS	.20322953 03	RAM	.98668862 02	LOM	.92392306 02
DUT	.34000000 02	DT	.48000000 03	DR	.28692546 01	SHA	.75346574 05	DES	-.97053760 01	DEM	.20892327 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13493873 09	Y	.63208507 08	Z	-.18527750 05	DX	-.14993211 02	DY	.29227709 02	DZ	-.15803671 00
R	.14900932 09	LAT	-.71241304-02	LON	.25099508 02	V	.32849357 02	PTH	-.20573204 01	AZ	.90276080 02
XE	.13496867 09	YE	.63141943 08	ZE	.21450000 03	DXE	-.13097084 02	DYE	.26876569 02	DZE	-.90944766-03
XT	.13491486 09	YT	.63519953 08	ZT	-.15166750 05	DXT	-.14117287 02	DYT	.26807618 02	DZT	.76129436-01
LTE	.82478300-04	LOE	.25071446 02	LTT	-.58274553-02	LOT	.25211764 02	RST	.14912010 09	VST	.30297722 02
EPS	.89142215 02	ESP	.27088086-01	SEP	.90828811 02	EPM	.15528486 03	EMP	.47293219 01	MEP	.19985799 02
MPS	.11071504 03	MSP	.11234211 00	SMP	.69172694 02	SEM	.10695572 03	EMS	.72903836 02	ESM	.14040588 00
EPT	.15528486 03	ETP	.47293219 01	TEP	.19985799 02	TPS	.11071504 03	TSP	.11234211 00	STP	.69172694 02
SET	.10695572 03	STE	.72903836 02	EST	.14040588 00	RPM	.31237824 06	RPT	.31237824 06	SPN	.84286892 02
GCE	.11833992 03	GCT	.28327467 03	SIP	.11039625 03	CPT	.76666983 02	SIN	.76348200 02	D1	.16691562 00
REP	.75354458 05	VEP	.30245408 01	CPE	.11834885 03	CPS	.92601822 02	D2	.59656564-01	D3	.35328436-03

0 DAYS 7 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437956.52596065 OCT. 19,1962 00 37 23.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.42942844 05	Y	.83114129 05	Z	.14774162 05	DX	-.17258067 01	DY	.18619557 01	DZ	.73536865 00
R	.94711784 05	DEC	.89742622 01	RA	.11732419 03	V	.26431146 01	PTH	.73263950 02	AZ	.63066638 02
R	.94711782 05	LAT	.89742622 01	LON	.80965450 02	VE	.66533265 01	PTE	.22360610 02	AZE	.27321193 03
XS	-.13487423 09	YS	-.58107506 08	ZS	-.25197039 08	DXS	.13136091 02	DYS	-.24641956 02	DZS	-.10684343 02
XM	-.61143943 05	YM	.35218598 06	ZM	.13655866 06	DXM	-.10171153 01	DYM	-.11229190 00	DZM	.36137603-01
XT	-.61143943 05	YT	.35218598 06	ZT	.13655866 06	DXT	-.10171153 01	DYT	-.11229190 00	DZT	.36137603-01
RS	.14900480 09	VS	.29898797 02	RM	.38265103 06	VM	.10239331 01	RT	.38265103 06	VT	.10239331 01
GED	.90344145 01	ALT	.88334102 05	LOS	.16694896 03	RAS	.20330770 03	RAM	.99849102 02	LOM	.63490368 02
DUT	.34000000 02	DT	.95999999 03	DR	.25311562 01	SHA	-.94628960 05	DES	-.97356234 01	DEM	.20908413 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13483129 09	Y	.63417532 08	Z	-.19302250 05	DX	-.14861898 02	DY	.28859360 02	DZ	-.66994428-01
R	.14900087 09	LAT	-.74223556-02	LON	.25189821 02	V	.32461410 02	PTH	-.20575705 01	AZ	.90118590 02
XE	.13487423 09	YE	.63335400 08	ZE	.20875000 03	DXE	-.13136091 02	DYE	.26858540 02	DZE	-.91898440-03
XT	.13481309 09	YT	.63712842 08	ZT	-.14615250 05	DXT	-.14153206 02	DYT	.26769893 02	DZT	.76909065-01
LTE	.80269181-04	LOE	.25154214 02	LTT	-.56159224-02	LOT	.25295480 02	RST	.14911034 09	VST	.30281122 02
EPS	.92359922 02	ESP	.37009371-01	SEP	.87603688 02	EPM	.15287909 03	EMP	.64787349 01	MEP	.20642167 02
MPS	.11165996 03	MSP	.10584016 00	SMP	.68234360 02	SEM	.10594022 03	EMS	.73918396 02	ESM	.14144723 00
EPT	.15287909 03	ETP	.64787349 01	TEP	.20642167 02	TPS	.11165996 03	TSP	.10584016 00	STP	.68234360 02
SET	.10594022 03	STE	.73918396 02	EST	.14144723 00	RPM	.29590945 06	RPT	.29590945 06	SPN	.88498637 02
GCE	.11583113 03	GCT	.28295301 03	SIP	.11132344 03	CPT	.76996933 02	SIN	.76660407 02	D1	.17620559 00
REP	.94711784 05	VEP	.26431146 01	CPE	.11565869 03	CPS	.92623858 02	D2	.65696188-01	D3	.41322949-03

0 DAYS 8 HRS. 18 MIN. 45.000 SEC. JULIAN DATE 2437956.58064815 OCT. 19,1962 01 56 08.000

CASE 1 SPACE TRAJECTORIES 6

RA-5 PREMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.50885405 05	Y	.91512283 05	Z	.18175038 05	DX	-.16386762 01	DY	.16995686 01	DZ	.70486263 00
R	.10627396 06	DEC	.98471656 01	RA	.11907624 03	V	.24638638 01	PTH	.74020547 02	AZ	.63348249 02
R	.10627396 06	LAT	.98471656 01	LON	.62976114 02	VE	.74238285 01	PTE	.18606204 02	AZE	.27247846 03
XS	-.13481210 09	YS	-.58223918 08	ZS	-.25247513 08	DXS	.13161679 02	DYS	-.24631075 02	DZS	-.10679618 02
XM	-.65944631 05	YM	.35162703 06	ZM	.13671840 06	DXM	-.10148907 01	DYM	-.12429467 00	DZM	.31478186-01
XT	-.65944631 05	YT	.35162703 06	ZT	.13671840 06	DXT	-.10148907 01	DYT	-.12429467 00	DZT	.31478186-01
RS	.14900256 09	VS	.29899396 02	RM	.38299109 06	VM	.10229581 01	RT	.38299109 06	VT	.10229581 01
GED	.99129450 01	ALT	.99896383 05	LOS	.14725887 03	RAS	.20335900 03	RAM	.10062195 03	LOM	.44521815 02
DUT	.34000000 02	DT	.48000000 03	DR	.23686613 01	SHA	-.10602975 06	DES	-.97554643 01	DEM	.20914560 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.23212513 OCT. 18,1962 17 34 15.612

SMA	.27859639 06	ECC	.97632419 00	INC	.28287315 02	LAN	.10025964 03	APF	.22717816 03	RCA	.65959960 04
VH	.13091948 00	C3	-.14307437 01	CI	.72083848 05	SLR	.13035827 05	APO	.55059679 06	TFP	.30112388 05
TA	.15397633 03	EA	.50688403 02	MA	.74075275 01	DAO	-.20339796 02	RAO	.32379734 03	MTA	.18000000 03
WX	.46631617 00	WY	.84404738-01	WZ	.88058229 00	PX	.75661881 00	PY	-.55381515 00	PZ	-.34758701 00
QX	.45834181 00	QY	.82835057 00	QZ	-.32211519 00	RX	-.74953308-01	RY	.45462823 00	RZ	-.88752190 00
SXO	.75661881 00	SYO	-.55381515 00	SZO	-.34758701 00	TX	-.64954596 00	TY	-.69756859 00	TZ	-.30247001 00
BX	-.45834179 00	BY	-.82835054 00	BZ	.32211518 00	MX	-.74383261 00	MY	-.50138435 00	MZ	.44195800 00
B.T	.46892240 05	B.R	-.37853043 05	B	.60263880 05	PER	.24390639 05	OMD	.11863935-01	NOD	-.72622272-02
C3J	-.17798684 01										

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13476121 09	Y	.63553473 08	Z	-.19527250 05	DX	-.14800355 02	DY	.28686377 02	DZ	-.30385732-01
R	.14899540 09	LAT	-.75091511-02	LON	.25248595 02	V	.32279400 02	PTH	-.20422667 01	AZ	.90054237 02
XE	.13481210 09	YE	.63462283 08	ZE	.20450000 03	DXE	-.13161679 02	DYE	.26846677 02	DZE	-.92506408-03
XT	.13474615 09	YT	.63839277 08	ZT	-.14250750 05	DXT	-.14176569 02	DYT	.26745165 02	DZT	.77403306-01
LTE	.78636140-04	LOE	.25208533 02	LTT	-.54760987-02	LOT	.25350396 02	RST	.14910392 09	VST	.30270199 02
EPS	.93844218 02	ESP	.40178123-01	SEP	.86115007 02	EPM	.15146097 03	EMP	.76181272 01	MEP	.20920897 02
MPS	.11222830 03	MSP	.10159538 00	SMP	.67669872 02	SEM	.10527545 03	EMS	.74582575 02	ESM	.14230920 00
EPT	.15146097 03	ETP	.76181272 01	TEP	.20920897 02	TPS	.11222830 03	TSP	.10159538 00	STP	.67669872 02
SET	.10527545 03	STE	.74582575 02	EST	.14230920 00	RPM	.28624987 06	RPT	.28624987 06	SPN	.90403561 02
GCE	.11465484 03	GCT	.28278572 03	SIP	.11188042 03	CPT	.77170306 02	SIN	.76822426 02	D1	.18215191 00
REP	.10627396 06	VEP	.24638638 01	CPE	.11437363 03	CPS	.92638092 02	D2	.69596876-01	D3	.45427388-03

215552316167	613727662776	614552267631	202723065212	204470112412	602556350055
	621001817		3723000		000000000000

APPENDIX C

Ranger 5 postmidcourse orbit

```
CASE  1                                         SPACE TRAJECTORIES                                              1

RA-5  POSTMIDCOURSE ORBIT
    EPHEMERIDES WITH VENUS VELOCITIES

  GME  .39860320 06     J  .16234500-02     H -.57499999-05     D  .78749999-05    RE  .63781650 04   REM  .63783149 04
    G  .66709998-19     A  .88745998 29     B  .88763998 29     C  .88800998 29   OME  .41780741-02    AU  .14959900 09
  GMM  .49007589 04   GMS  .13271544 12   GMV  .32476950 06   GMA  .42977799 05   GMC  .00000000 00   GMJ  .12671060 09

INJECTION CONDITIONS           MOON           JULIAN DATE 2437956.58064815          OCT. 19,1962   01 56 08.000

GEOCENTRIC      X0-.50885925 05  Y0 .91512069 05  Z0 .18173407 05 DX0-.16380212 01 DY0 .16998046 01 DZ0 .70499460 00
CARTESIAN          GMC .00000000 00 SGC .00000000 00  T0 .69679999 04 GHA .56100134 02 GHC .26987313 02

  0 DAYS  0 HRS.  0 MIN.  0.000 SEC.            JULIAN DATE 2437956.58064815          OCT. 19,1962   01 56 08.000

GEOCENTRIC                                                                               EQUATORIAL COORDINATES

    X -.50885922 05     Y  .91512065 05     Z  .18173406 05    DX -.16380211 01    DY  .16998045 01    DZ  .70499457 00
    R  .10627374 06   DEC  .98462939 01    RA  .11907655 03     V  .24636286 01   PTH  .74032094 02    AZ  .63307776 02
    R  .10627374 06   LAT  .98462939 01   LON  .62976418 02    VE  .74244739 01   PTE  .18603799 02   AZE  .27247972 03
   XS -.13481210 09    YS -.58223920 08    ZS -.25247514 08   DXS  .13161679 02   DYS -.24631075 02   DZS -.10679618 02
   XM -.65944638 05    YM  .35162703 06    ZM  .13671840 06   DXM -.10148907 01   DYM -.12429469 00   DZM  .31478179-01
   XT -.65944638 05    YT  .35162703 06    ZT  .13671840 06   DXT -.10148907 01   DYT -.12429469 00   DZT  .31478179-01
   RS  .14900256 09    VS  .29899396 02    RM  .38299109 06    VM  .10229581 01    RT  .38299109 06    VT  .10229581 01
  GED  .99120677 01   ALT  .99896163 05   LOS  .14725887 03   RAS  .20335900 03   RAM  .10062195 03   LOM  .44521816 02
  DLT  .34000000 02    DT  .24000000 03    DR  .23685719 01   SHA -.10602947 06   DES -.97554643 01   DEM  .20914560 02

GEOCENTRIC                                         CONIC        ORBITAL B.T AND B.R       EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE                      JULIAN DATE 2437956.23215275          OCT. 18,1962   17 34 17.998
  SMA  .27835862 06   ECC  .97634232 00   INC  .28324781 02   LAN  .10029226 03   APF  .22712511 03   RCA  .65853187 04
   VH  .13092513 00    C3 -.14319772 01    C1  .72026096 05   SLR  .13014844 05   APO  .55013192 06   TFP  .30110002 05
   TA  .15400054 03    EA  .50713921 02    MA  .74164622 01   DAC -.20347347 02   RAC  .32376676 03   MTA  .18000000 03
   WX  .46683455 00    WY  .84773099-01    WZ  .88027222 00    PX  .75628616 00    PY -.55419180 00    PZ -.34771056 00
   QX  .45836316 00    QY  .82806104 00    QZ -.32282861 00    RX -.28046945 00    RY  .20552256 00    RZ -.93760189 00
  SXO  .75628616 00   SYO -.55419180 00   SZO -.34771056 00    TX -.59107368 00    TY -.80661757 00    TZ  .00000000 00
   BX -.45836313 00    BY -.82806097 00    BZ  .32282858 00    MX -.74350365 00    MY -.50132269 00    MZ  .44258112 00
  B.T  .56509357 05   B.R -.20724085 05     B  .60189660 05   PER  .24359324 05   OMD  .11906212-01   NOD -.72924592-02
  C3J -.17807014 01

HELIOCENTRIC                                                                              ECLIPTIC COORDINATES

    X  .13476121 09     Y  .63553474 08     Z -.19529250 05    DX -.14799700 02    DY  .28686646 02    DZ -.30358553-01
    R  .14899540 09   LAT -.75099204-02   LON  .25248595 02     V  .32279338 02   PTH -.20410150 01    AZ  .90054189 02
   XE  .13481210 09    YE  .63462286 08    ZE  .20400000 03   DXE -.13161679 02   DYE  .26846677 02   DZE -.92506408-03
   XT  .13474615 09    YT  .63839281 08    ZT -.14251000 05   DXT -.14176570 02   DYT  .26745164 02   DZT  .77403187-01
  LTE  .78443875-04   LOE  .25208534 02   LTT -.54761947-02   LOT  .25350397 02   RST  .14910392 09   VST  .30270199 02
  EPS  .93844673 02   ESP  .41377734-01   SEP  .86114552 02   EPM  .15146001 03   EMP  .76183525 01   MEP  .20921633 02
  MPS  .11222841 03   MSP  .10207574 00   SMP  .67669761 02   SEM  .10527545 03   EMS  .74582575 02   ESM  .14265252 00
  EPT  .15146001 03   ETP  .76183525 01   TEP  .20921633 02   TPS  .11222841 03   TSP  .10207574 00   STP  .67669761 02
  SET  .10527545 03   STE  .74582575 02   EST  .14265252 00   RPM  .28625072 06   RPT  .28625072 06   SPN  .90404008 02
  GCE  .11465564 03   GCT  .28278542 03   SIP  .11188053 03   CPT  .77170591 02   SIN  .76822711 02    D1  .18215137 00
  REP  .10627374 06   VEP  .24636286 01   CPE  .11437440 03   CPS  .92638093 02    D2  .69596995-01    D3  .45427369-03

  0 DAYS  2 HRS.  3 MIN. 52.000 SEC.            JULIAN DATE 2437956.66666666          OCT. 19,1962   04 00 00.000
```

CASE 1 SPACE TRAJECTCRIES 2

RA-5 PCSTMIDCCURSE ORBIT

GECCENTRIC EQUATORIAL CCORDINATES

X	-.62628797 C5	Y	.1C339344 06	Z	.23257251 C5	DX	-.15263963 C1	DY	.15077636 01	DZ	.66442157 00
R	.12309943 06	CEC	.1C890383 C2	RA	.12120466 03	V	.22460394 C1	PTH	.749C16C5 02	AZ	.6368C271 02
R	.12309943 C6	LAT	.1C890383 02	LON	.34053C81 02	VE	.85733311 C1	PTE	.14651329 C2	AZE	.27179211 C3
XS	-.13471413 C9	YS	-.58406921 08	ZS	-.25326860 C8	DXS	.13201908 C2	DYS	-.24613912 C2	DZS	-.10672165 02
XM	-.73473394 05	YM	.35063342 06	ZM	.13692515 C6	DXM	-.1C110773 C1	DYM	-.14307037 00	DZM	.24163526-01
XT	-.73473394 C5	YT	.35063342 C6	ZT	.13692515 06	DXT	-.10110773 C1	DYT	-.14307037 00	DZT	.24163526-C1
RS	.14899904 C9	VS	.29900337 02	RM	.38352396 06	VM	.1C214354 C1	RT	.38352396 06	VT	.10214354 C1
GED	.10962806 02	ALT	.11672199 06	LOS	.11628814 03	RAS	.2C343972 C3	RAM	.10183479 C3	LCM	.14683213 02
DLT	.34CCC000 02	DT	.95999999 03	DR	.21685C60 01	SHA	-.12249921 C6	DES	-.97866586 01	DEM	.20917204 02

HELIOCENTRIC ECLIPTIC CCORDINATES

X	.1346515C 09	Y	.63765859 C8	Z	-.19597750 C5	DX	-.14728305 C2	DY	.28475603 02	DZ	.88082551-02
R	.14898695 09	LAT	-.75366891-02	LON	.25340465 C2	V	.32C59055 C2	PTH	-.20C86869 C1	AZ	.89984509 02
XE	.13471413 C9	YE	.63661747 C8	ZE	.19775000 03	DXE	-.13201908 C2	DYE	.26827966 C2	DZE	-.9343624C-03
XT	.13464C65 C9	YT	.64037912 08	ZT	-.13672250 C5	DXT	-.14212986 C2	DYT	.26706317 C2	DZT	.78152537-01
LTE	.76042369-04	LOE	.25293976 02	LTT	-.52541568-C2	LOT	.25436738 C2	RST	.14909380 C9	VST	.30252974 C2
EPS	.95613226 02	ESP	.46393702-01	SEP	.84339662 C2	EPM	.14950143 C3	EMP	.93751004 01	MEP	.21123459 02
MPS	.11305179 03	MSP	.96407213-C1	SMP	.66851903 02	SEM	.1C423246 C3	EMS	.75624679 02	ESM	.1423C92C 0C
EPT	.14950143 C3	ETP	.93751004 01	TEP	.21123459 02	TPS	.11305179 C3	TSP	.96407213-01	STP	.66851903 02
SET	.10423246 03	STE	.75624679 02	EST	.1423092C CC	RPM	.27233362 C6	RPT	.27233362 06	SPN	.9264330C C2
GCE	.11322539 03	GCT	.28256752 C3	SIP	.11268613 03	CPT	.77398211 C2	SIN	.77C32553 02	D1	.19146C25 C0
REP	.12309943 06	VEP	.22460394 01	CPE	.11279874 03	CPS	.9266C232 C2	D2	.75707494-C1	D3	.52239764-03

C DAYS 6 HRS. 3 MIN. 52.CCC SEC. JULIAN DATE 2437956.83333333 OCT. 19,1962 08 0C C0.CCC

GECCENTRIC EQUATORIAL CCORDINATES

X	-.83380713 C5	Y	.12315872 06	Z	.32363268 C5	DX	-.13652C79 C1	DY	.12567584 01	DZ	.60344145 00
R	.15220970 06	CEC	.12276105 02	RA	.12409872 03	V	.19512498 C1	PTH	.75972179 02	AZ	.6422897C 02
R	.1522097C C6	LAT	.12276105 02	LON	.33678287 C3	VE	.10592154 C2	PTE	.10295378 02	AZE	.27113C61 03
XS	-.13452345 09	YS	-.58761142 08	ZS	-.25480444 C8	DXS	.13279794 C2	DYS	-.24580494 C2	DZS	-.10657656 02
XM	-.87973703 05	YM	.34831339 06	ZM	.13717138 06	DXM	-.1CC26111 01	DYM	-.17906824 CO	DZM	.10049267-01
XT	-.87973703 05	YT	.34831339 06	ZT	.13717138 06	DXT	-.10026111 C1	DYT	-.179C6824 C0	DZT	.10049267-01
RS	.14899222 C9	VS	.29902161 02	RM	.38454853 06	VM	.1C185261 C1	RT	.38454853 06	VT	.10185261 01
GED	.12357202 02	ALT	.14583247 06	LOS	.56280317 02	RAS	.2C359617 03	RAM	.10417477 03	LCM	.31685892 03
DLT	.34C00000 02	DT	.19200CCC C4	DR	.18930599 C1	SHA	-.15072944 C6	DES	-.98470494 C1	DEM	.20898133 02

HELIOCENTRIC ECLIPTIC CCORDINATES

X	.13444006 C9	Y	.641737C0 08	Z	-.1912075C C5	DX	-.14645CC2 C2	DY	.28184626 02	DZ	.52702307-C1
R	.14897112 C9	LAT	-.73540308-02	LON	.25517C37 02	V	.31762430 C2	PTH	-.19397925 C1	AZ	.899C5123 02
XE	.13452345 C9	YE	.64047832 08	ZE	.18375000 03	DXE	-.13279794 C2	DYE	.26791535 02	DZE	-.95140933-03
XT	.13443547 C9	YT	.64421966 08	ZT	-.12537500 05	DXT	-.142824C5 C2	DYT	.26631245 02	DZT	.79507469-C1
LTE	.70662C71-C4	LOE	.25459542 02	LTT	-.48187165-02	LCT	.25603909 C2	RST	.14907410 C9	VST	.30219474 02
EPS	.97939240 02	ESP	.58516955-01	SEP	.82002785 02	EPM	.14643662 C3	EMP	.12640281 C2	MEP	.20923C89 C2
MPS	.1144478C C3	MSP	.87356456-01	SMP	.65465286 02	SEM	.1C222062 C3	EMS	.77634928 02	ESM	.14486432 CC
EPT	.14643662 03	ETP	.12640281 02	TEP	.20923089 02	TPS	.1144478C C3	TSP	.87356456-01	STP	.65465286 02
SET	.10222062 03	STE	.77634928 02	EST	.14486432 CC	RPM	.24839577 C6	RPT	.24839577 06	SPN	.95537689 C2
GCE	.11127601 C3	GCT	.28224603 C3	SIP	.114C4690 03	CPT	.77737483 C2	SIN	.77336586 02	D1	.20991209 00
REP	.15220970 06	VEP	.19512498 01	CPE	.11063851 C3	CPS	.92702534 C2	D2	.87721065-01	D3	.67043186-03

C DAYS 1C HRS. 3 MIN. 52.CCC SEC. JULIAN DATE 2437957.CCCCCCCC OCT. 19,1962 12 00 CO.CCC

CASE 1 SPACE TRAJECTORIES 3

RA-5 PCSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.10214788 06	Y	.13997761 06	Z	.40706C06 C5	DX	-.12465939 C1	DY	.10888186 01	DZ	.55715407 00
R	.178CC252 06	DEC	.13219499 02	RA	.12611989 03	V	.17464C86 C1	PTH	.76619537 02	AZ	.64622C26 02
R	.17800252 06	LAT	.13219499 02	LON	.27663977 03	VE	.12389313 C2	PTE	.78820655 C1	AZE	.27080871 03
XS	-.13433165 C9	YS	-.5911488C 08	ZS	-.25633818 08	DXS	.13357598 C2	DYS	-.24546861 C2	DZS	-.10643055 C2
XM	-.10234204 06	YM	.34547881 06	ZM	.137215C0 C6	DXM	-.99275308 C0	DYM	-.21452697 CC	DZM	-.39721983-02
XT	-.10234204 06	YT	.34547881 06	ZT	.137215C0 06	DXT	-.99275308 CC	DYT	-.21452697 00	DZT	-.39721983-02
RS	.14898541 09	VS	.29903986 02	RM	.38556122 06	VM	.10156753 C1	RT	.38556122 06	VT	.10156753 01
GED	.13306392 C2	ALT	.17162544 06	LOS	.35627257 03	RAS	.20375269 C3	RAM	.10650100 03	LOM	.259C2088 C3
DUT	.34C0C0CC 02	DT	.19200000 04	DR	.16990C21 01	SHA	-.17553151 06	DES	-.99073754 C1	DEM	.20847620 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.1342295C 09	Y	.64578CC6 08	Z	-.18171500 05	DX	-.14604192 C2	DY	.27975467 02	DZ	.77032088-01
R	.14895596 C9	LAT	-.69896514-02	LON	.25692274 C2	V	.31558123 C2	PTH	-.18739008 01	AZ	.89860295 C2
XE	.13433165 C9	YE	.64433388 08	ZE	.16675CCC C3	DXE	-.13357598 C2	DYE	.26754868 C2	DZE	-.96666812-03
XT	.13422930 C9	YT	.64804939 C8	ZT	-.11383250 05	DXT	-.14350351 C2	DYT	.26556468 02	DZT	.80734610-01
LTE	.65281279-04	LCE	.25625126 02	LTT	-.4375668C-C2	LOT	.2577C515 C2	RST	.149C5431 09	VST	.30185843 C2
EPS	.9949044C 02	ESP	.67448792-01	SEP	.80442039 C2	EPM	.14404655 C3	EMP	.15727349 02	MEP	.20226C92 C2
MPS	.11563C72 03	MSP	.79437864-01	SMP	.64290589 02	SEM	.10022050 C3	EMS	.79633639 02	ESM	.1462088C 00
EPT	.144C4655 03	ETP	.15727349 02	TEP	.20226092 02	TPS	.11563072 C3	TSP	.79437864-01	STP	.64290589 02
SET	.10022050 03	STE	.79633639 02	EST	.1462088C CC	RPM	.22703473 C6	RPT	.227C3473 06	SPN	.97437038 02
GCE	.10990748 03	GCT	.28200591 03	SIP	.11519211 C3	CPT	.77992472 C2	SIN	.77553856 02	D1	.22966322 00
REP	.17800252 06	VEP	.17464C86 C1	CPE	.10912088 C3	CPS	.92744317 02	D2	.10031855 CC	D3	.84650732-03

C DAYS 14 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437957.1666666 OCT. 19,1962 16 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.11940236 06	Y	.15472732 C6	Z	.48453139 C5	DX	-.11531748 C1	DY	.96537593 00	DZ	.52007914 00
R	.20135832 06	DEC	.1392381C C2	RA	.12765720 03	V	.15913030 C1	PTH	.77041066 02	AZ	.6490274C 02
R	.20135832 06	LAT	.1392381C 02	LON	.22001282 C3	VE	.14015552 C2	PTE	.63525958 01	AZE	.27062260 03
XS	-.13413873 C9	YS	-.59468127 C8	ZS	-.25786980 08	DXS	.13435316 C2	DYS	-.24513012 02	DZS	-.10628362 02
XM	-.11655859 06	YM	.34213777 06	ZM	.1370575C C6	DXM	-.98153929 CC	DYM	-.24940537 00	DZM	-.17882718-01
XT	-.11655859 06	YT	.34213777 C6	ZT	.1370575C C6	DXT	-.98153929 C0	DYT	-.24940537 C0	DZT	-.17882718-01
RS	.14897861 09	VS	.29905811 02	RM	.38656036 06	VM	.1012888C C1	RT	.38656036 06	VT	.1012888C 01
GED	.1401497C C2	ALT	.19498136 06	LOS	.29626490 C3	RAS	.20390929 C3	RAM	.10881281 C3	LCM	.20116843 C3
DUT	.34C0C0C0 02	DT	.19200000 04	DR	.15507742 C1	SHA	-.19786229 06	DES	-.99676338 01	DEM	.20766267 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13401933 09	Y	.64979642 C8	Z	-.16945500 05	DX	-.14588491 C2	DY	.27810564 02	DZ	.92113017-01
R	.14894138 09	LAT	-.65187095-02	LON	.25866554 C2	V	.31404777 C2	PTH	-.18134553 01	AZ	.89832066 02
XE	.13413873 09	YE	.64818411 08	ZE	.15650CC0 03	DXE	-.13435316 C2	DYE	.26717968 02	DZE	-.9804964C-03
XT	.13402217 C9	YT	.65186834 08	ZT	-.10212250 05	DXT	-.14416856 C2	DYT	.26482034 02	DZT	.81834196-01
LTE	.60188434-04	LOE	.25790724 C2	LTT	-.39260641-C2	LOT	.25937751 C2	RST	.14903445 09	VST	.30152124 02
EPS	.10061618 03	ESP	.76296776-01	SEP	.79307707 C2	EPM	.14212316 C3	EMP	.18651642 02	MEP	.19225197 02
MPS	.11663750 03	MSP	.71326247-01	SMP	.63291250 02	SEM	.98231844 02	EMS	.81621073 02	ESM	.14720910 00
EPT	.14212316 03	ETP	.18651642 02	TEP	.19225197 02	TPS	.11663750 C3	TSP	.71326247-C1	STP	.63291250 02
SET	.98231844 02	STE	.81621073 02	EST	.14720910 0C	RPM	.20731978 C6	RPT	.20731978 06	SPN	.98801038 C2
GCE	.10885987 C3	GCT	.28181606 03	SIP	.11415718 03	CPT	.78193324 C2	SIN	.77712996 02	D1	.25150437 C0
REP	.20135832 06	VEP	.15913030 01	CPE	.10796238 03	CPS	.92785741 C2	D2	.11388891 CC	D3	.10608593-02

C DAYS 18 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437957.33333333 OCT. 19,1962 20 00 00.000

CASE 1 SPACE TRAJECTORIES 4

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.13543800 06	Y	.16791C24 06	Z	.55714283 C5	DX	-.1C762576 C1	DY	.86923134 00	DZ	.48929426 CC
R	.22280347 06	DEC	.14481075 02	RA	.12888998 C3	V	.14674135 C1	PTH	.77326918 02	AZ	.65089224 02
R	.22280346 06	LAT	.14481075 02	LON	.161C8132 03	VE	.15505768 C2	PTE	.52977260 01	AZE	.27050321 03
XS	-.13394470 09	YS	-.59820888 08	ZS	-.25939931 08	DXS	.13512950 C2	DYS	-.24478945 02	DZS	-.10613578 02
XM	-.13060414 06	YM	.33829887 06	ZM	.13670059 06	DXM	-.96900627 CC	DYM	-.28366454 C0	DZM	-.31664949-C1
XT	-.13060414 06	YT	.33829887 06	ZT	.13670059 C6	DXT	-.96900627 CC	DYT	-.28366454 CC	DZT	-.31664949-01
RS	.14897181 09	VS	.29907634 02	RM	.38754434 06	VM	.1C101690 C1	RT	.38754434 06	VT	.101C1690 01
GED	.14575571 02	ALT	.21642661 06	LOS	.23625731 03	RAS	.20406596 C3	RAM	.11110965 03	LOM	.14330100 C3
DUT	.3400000C 02	DT	.1920000C 04	DR	.14316640 C1	SHA	-.21828388 C6	DES	-.10027826 02	DEM	.20654712 C2

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13380926 09	Y	.65379119 C8	Z	-.15542250 05	DX	-.14589208 C2	DY	.27672972 02	DZ	.10210633 0C
R	.14892732 09	LAT	-.59794622-C2	LON	.26040105 02	V	.31283363 C2	PTH	-.17581300 01	AZ	.89813084 02
XE	.1339447C 09	YE	.65202903 08	ZE	.14225C00 C3	DXE	-.13512950 C2	DYE	.26680832 02	DZE	-.99253654-C3
XT	.13381409 09	YT	.65567663 08	ZT	-.9C2675CC C4	DXT	-.14481957 C2	DYT	.264C7984 C2	DZT	.828C7C63-C1
LTE	.54710513-04	LOE	.25956342 02	LTT	-.34707667-02	LOT	.26104424 C2	RST	.14901453 C9	VST	.30118359 02
EPS	.10147615 C3	ESP	.84799127-01	SEP	.78439870 C2	EPM	.14C5491C C3	EMP	.21426537 02	MEP	.18024361 C2
MPS	.11749C71 03	MSP	.64482543-01	SMP	.62444919 C2	SEM	.96254371 C2	EMS	.83597502 C2	ESM	.148C3752 CC
EPT	.14054910 03	ETP	.21426537 02	TEP	.18024361 C2	TPS	.11749071 C3	TSP	.64482543-C1	STP	.62444919 02
SET	.96254371 02	STE	.83597502 C2	EST	.14803752 00	RPM	.18871786 C6	RPT	.18871786 C6	SPN	.99835769 02
GCE	.10801370 C3	GCT	.28165963 03	SIP	.11696303 C3	CPT	.78356291 C2	SIN	.77828616 02	C1	.27629717 CC
REP	.22280347 06	VEP	.14674135 01	CPE	.10703049 C3	CPS	.92826899 C2	D2	.12886210 C0	C3	.13277826-C2

C DAYS 22 HRS. 3 MIN. 52.COO SEC. JULIAN DATE 2437957.500000CC OCT. 2C,1962 0C CC C0.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.15045388 06	Y	.17984854 06	Z	.62566701 05	DX	-.1C109105 C1	DY	.79141129 00	DZ	.46309256 CC
R	.24268592 06	DEC	.14940116 02	RA	.12991446 C3	V	.13648174 C1	PTH	.77526435 C2	AZ	.65185218 02
R	.24268592 06	LAT	.14940116 02	LON	.10194149 03	VE	.16884262 C2	PTE	.45268171 01	AZE	.27042114 03
XS	-.13374954 09	YS	-.60173155 08	ZS	-.26092667 08	DXS	.13590498 C2	DYS	-.24444663 C2	DZS	-.10598701 C2
XM	-.14445993 C6	YM	.33397133 06	ZM	.13614623 C6	DXM	-.95519137 CC	DYM	-.31726768 CC	DZM	-.45302295-C1
XT	-.14445993 C6	YT	.33397133 06	ZT	.13614623 C6	DXT	-.95519137 CC	DYT	-.31726768 CC	DZT	-.45302295-C1
RS	.14896502 09	VS	.29909457 C2	RM	.38851167 C6	VM	.1CC75225 C1	RT	.38851167 C6	VT	.10075225 C1
GED	.15037332 02	ALT	.23630915 06	LOS	.17624973 03	RAS	.20422271 C3	RAM	.11339099 03	LOM	.85418015 C2
DUT	.3400000C 02	DT	.1920000C 04	DR	.13326020 C1	SHA	-.23716319 C6	DES	-.10C87952 02	DEM	.20513631 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13359909 09	Y	.6577675C C8	Z	-.14019750 05	DX	-.14601408 C2	DY	.27553780 C2	DZ	.109C1606 00
R	.14891373 C9	LAT	-.53942138-02	LON	.26213066 02	V	.3118371C C2	PTH	-.17C71298 01	AZ	.89799768 02
XE	.13374954 09	YE	.65586856 08	ZE	.12750000 C3	DXE	-.13590498 C2	DYE	.26643460 C2	DZE	-.10032654-C2
XT	.13360508 C9	YT	.65947423 08	ZT	-.78285C00 04	DXT	-.14545689 C2	DYT	.26334358 C2	DZT	.83652972-01
LTE	.49039780-04	LOE	.26121977 02	LTT	-.30104453-02	LOT	.26270930 C2	RST	.14899457 C9	VST	.30084588 02
EPS	.10215545 03	ESP	.90923484-01	SEP	.77753299 02	EPM	.13925469 C3	EMP	.24C61136 02	MEP	.16684173 C2
MPS	.11820402 03	MSP	.58097472-01	SMP	.6173806C 02	SEM	.94287798 C2	EMS	.85563215 C2	ESM	.14869693 CC
EPT	.13925469 03	ETP	.24061136 02	TEP	.16684173 02	TPS	.11820402 C3	TSP	.58097472-C1	STP	.61738C6C 02
SET	.94287798 02	STE	.85563215 02	EST	.14869693 00	RPM	.17089093 C6	RPT	.17089093 06	SPN	.10064949 03
GCE	.10730470 C3	GCT	.28152592 03	SIP	.11762130 C3	CPT	.784915C3 C2	SIN	.77908780 02	C1	.30512266 CC
REP	.24268592 06	VEP	.13648174 01	CPE	.10625334 03	CPS	.92867847 C2	D2	.14577493 CC	C3	.16683118-C2

1 DAYS 2 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437957.66666666 OCT. 2C,1962 04 00 C0.000

CASE 1 SPACE TRAJECTORIES 5

RA-5 PCSTMICCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.16459301 06	Y	.19076569 06	Z	.69068197 05	DX	-.95408124 00	DY	.72674670 00	DZ	.44041650 00
R	.26125241 06	DEC	.15329724 02	RA	.13078769 03	V	.12776535 01	PTH	.77671107 02	AZ	.65183198 02
R	.26125240 06	LAT	.15329725 02	LON	.42650450 02	VE	.18168676 02	PTE	.39393227 01	AZE	.27036195 03
XS	-.13355327 09	YS	-.60524926 08	ZS	-.26245188 08	DXS	.13667958 02	DYS	-.24410164 02	DZS	-.10583731 02
XM	-.15810777 06	YM	.32916484 06	ZM	.13539665 06	DXM	-.94013208 00	DYM	-.35017975 00	DZM	-.58778717-01
XT	-.15810777 06	YT	.32916484 06	ZT	.13539665 06	DXT	-.94013208 00	DYT	-.35017975 00	DZT	-.58778717-01
RS	.14895823 09	VS	.29911277 02	RM	.38946093 06	VM	.10049523 01	RT	.38946093 06	VT	.10049523 01
GED	.15429232 02	ALT	.25487571 06	LOS	.11624229 03	RAS	.20437953 03	RAM	.11565637 03	LOM	.27519133 02
DUT	.34000000 02	DT	.19200000 04	DR	.12481883 01	SHA	-.25475793 06	DES	-.10148010 02	DEM	.20343733 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13338868 09	Y	.66172766 08	Z	-.12412250 05	DX	-.14622039 02	DY	.27447825 02	DZ	.11392844 00
R	.14890055 09	LAT	-.47761374-02	LON	.26385541 02	V	.31099841 02	PTH	-.16596395 01	AZ	.89790156 02
XE	.13355327 09	YE	.65970270 08	ZE	.11325000 03	DXE	-.13667958 02	DYE	.26605853 02	DZE	-.10122061-02
XT	.13339517 09	YT	.66326129 08	ZT	-.66182499 04	DXT	-.14608090 02	DYT	.26261194 02	DZT	.84373473-01
LTE	.43560849-04	LOE	.26287630 02	LTT	-.25453857-02	LOT	.26437271 02	RST	.14897458 09	VST	.30050852 02
EPS	.10270413 03	ESP	.97667492-01	SEP	.77197833 02	EPM	.13819787 03	EMP	.26559825 02	MEP	.15242303 02
MPS	.11878433 03	MSP	.52339155-01	SMP	.61163889 02	SEM	.92331820 02	EMS	.87518513 02	ESM	.14951711 00
EPT	.13819787 03	ETP	.26559825 02	TEP	.15242303 02	TPS	.11878433 03	TSP	.52339155-01	STP	.61163889 02
SET	.92331820 02	STE	.87518513 02	EST	.14951711 00	RPM	.15360940 06	RPT	.15360940 06	SPN	.10130522 03
GCE	.10669460 03	GCT	.28140726 03	SIP	.11813605 03	CPT	.78606061 02	SIN	.77957778 02	D1	.33945408 00
REP	.26125241 06	VEP	.12776535 01	CPE	.10 58795 03	CPS	.92908622 02	D2	.16534907 00	D3	.21147442-02

1 DAYS 6 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437957.83333333 OCT. 20,1962 08 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.17796259 06	Y	.20082659 06	Z	.75264350 05	DX	-.90375510 00	DY	.67207732 00	DZ	.42059600 00
R	.27868751 06	DEC	.15668263 02	RA	.13154577 03	V	.12022322 01	PTH	.77784730 02	AZ	.65063240 02
R	.27868750 06	LAT	.15668263 02	LON	.34324427 03	VE	.19372374 02	PTE	.34773551 01	AZE	.27031778 03
XS	-.13335589 09	YS	-.60876198 08	ZS	-.26397493 08	DXS	.13745329 02	DYS	-.24375448 02	DZS	-.10568670 02
XM	-.17153003 06	YM	.32388960 06	ZM	.13445425 06	DXM	-.92386647 00	DYM	-.38236783 00	DZM	-.72079007-01
XT	-.17153003 06	YT	.32388960 06	ZT	.13445425 06	DXT	-.92386647 00	DYT	-.38236783 00	DZT	-.72079007-01
RS	.14895144 09	VS	.29913095 02	RM	.39039079 06	VM	.10024619 01	RT	.39039079 06	VT	.10024619 01
GED	.15769744 02	ALT	.27231087 06	LOS	.56134914 02	RAS	.20453642 03	RAM	.11790543 03	LOM	.32960392 03
DUT	.34000000 02	DT	.19200000 04	DR	.11750131 01	SHA	-.27125963 06	DES	-.10207999 02	DEM	.20145745 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13317793 09	Y	.66567332 08	Z	-.10744500 05	DX	-.14649084 02	DY	.27351940 02	DZ	.11748564 00
R	.14888778 09	LAT	-.41347550-02	LON	.26557604 02	V	.31028021 02	PTH	-.16148992 01	AZ	.89783081 02
XE	.13335589 09	YE	.66353139 08	ZE	.98999999 02	DXE	-.13745329 02	DYE	.26568011 02	DZE	-.10197162-02
XT	.13318436 09	YT	.66703784 08	ZT	-.53987499 04	DXT	-.14669196 02	DYT	.26188529 02	DZT	.84968923-01
LTE	.38081417-04	LOE	.26453299 02	LTT	-.20766435-02	LOT	.26603447 02	RST	.14895459 09	VST	.30017188 02
EPS	.10315368 03	ESP	.10444440 00	SEP	.76741925 02	EPM	.13735524 03	EMP	.28921470 02	MEP	.13723280 02
MPS	.11923187 03	MSP	.47436387-01	SMP	.60722237 02	SEM	.90386132 02	EMS	.89463704 02	ESM	.15033281 00
EPT	.13735524 03	ETP	.28921470 02	TEP	.13723280 02	TPS	.11923187 03	TSP	.47436387-01	STP	.60722237 02
SET	.90386132 02	STE	.89463704 02	EST	.15033281 00	RPM	.13670891 06	RPT	.13670891 06	SPN	.10184231 03
GCE	.10615886 03	GCT	.28129729 03	SIP	.11850344 03	CPT	.78705521 02	SIN	.77977093 02	D1	.38142515 00
REP	.27868751 06	VEP	.12022322 01	CPE	.10 00672 03	CPS	.92949252 02	D2	.18861012 00	D3	.27189408-02

1 DAYS 10 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437958.00000000 OCT. 20,1962 12 00 00.000

CASE 1 SPACE TRAJECTORIES 6

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.19064566 06	Y	.21015989 06	Z	.81193069 05	DX	-.85853471 00	DY	.62543717 00	DZ	.40322424 00
R	.29513600 06	DEC	.15968206 02	RA	.13221261 03	V	.11361528 01	PTH	.77889271 02	AZ	.64787556 02
R	.29513600 06	LAT	.15968206 02	LON	.28374683 03	VE	.20505936 02	PTE	.31053992 01	AZE	.27028412 03
XS	-.13315739 09	YS	-.61226970 08	ZS	-.26549581 08	DXS	.13822611 02	DYS	-.24340515 02	DZS	-.10553516 02
XM	-.18470961 06	YM	.31815623 06	ZM	.13332168 06	DXM	-.90643291 00	DYM	-.41380090 00	DZM	-.85188603-01
XT	-.18470961 06	YT	.31815623 06	ZT	.13332168 06	DXT	-.90643291 00	DYT	-.41380090 00	DZT	-.85188603-01
RS	.14894466 09	VS	.29914911 02	RM	.39130002 06	VM	.10000544 01	RT	.39130002 06	VT	.10000544 01
GED	.16071424 02	ALT	.28875943 06	LOS	.35622762 03	RAS	.20469339 03	RAM	.12013784 03	LCM	.27167207 03
DUT	.34000000 02	DT	.19200000 04	DR	.11108666 01	SHA	-.28681808 06	DES	-.10267920 02	DEM	.19920424 02

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.13296674 09	Y	.66960577 08	Z	-.90329999 04	DX	-.14681146 02	DY	.27264160 02	DZ	.12009668 00
R	.14887536 09	LAT	-.34764165-02	LON	.26729317 02	V	.30965867 02	PTH	-.15721618 01	AZ	.89777797 02
XE	.13315739 09	YE	.66735463 08	ZE	.84000000 02	DXE	-.13822611 02	DYE	.26529932 02	DZE	-.10257959-02
XT	.13297268 09	YT	.67080396 08	ZT	-.41717500 04	DXT	-.14729044 02	DYT	.26116396 02	DZT	.85440396-01
LTE	.32312976-04	LOE	.26618989 02	LTT	-.16048902-02	LOT	.26769459 02	RST	.14893459 09	VST	.29983632 02
EPS	.10352473 03	ESP	.10992114 00	SEP	.76364880 02	EPM	.13671909 03	EMP	.31137390 02	MEP	.12143521 02
MPS	.11953868 03	MSP	.40178123-01	SMP	.60421127 02	SEM	.88450408 02	EMS	.91399109 02	ESM	.15033281 00
EPT	.13671909 03	ETP	.31137390 02	TEP	.12143521 02	TPS	.11953868 03	TSP	.40178123-01	STP	.60421127 02
SET	.88450408 02	STE	.91399109 02	EST	.15033281 00	RPM	.12006598 06	RPT	.12006598 06	SPN	.10228645 03
GCE	.10568082 03	GCT	.28118988 03	SIP	.11870928 03	CPT	.78794879 02	SIN	.77965473 02	D1	.43430672 00
REP	.29513600 06	VEP	.11361528 01	CPE	.10449099 03	CPS	.92989755 02	D2	.21709353 00	D3	.35686807-02

1 DAYS 14 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437958.16666666 OCT. 20,1962 16 00 00.000

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.20270807 06	Y	.21887209 06	Z	.86888005 05	DX	-.81741156 00	DY	.58568405 00	DZ	.38811225 00
R	.31071704 06	DEC	.16238544 02	RA	.13280427 03	V	.10778769 01	PTH	.78009939 02	AZ	.64287402 02
R	.31071704 06	LAT	.16238544 02	LON	.22417423 03	VE	.21578172 02	PTE	.28007233 01	AZE	.27025826 03
XS	-.13295778 09	YS	-.61577234 08	ZS	-.26701450 08	DXS	.13899802 02	DYS	-.24305364 02	DZS	-.10538269 02
XM	-.19762997 06	YM	.31197586 06	ZM	.13200179 06	DXM	-.88786992 00	DYM	-.44444962 00	DZM	-.98093580-01
XT	-.19762997 06	YT	.31197586 06	ZT	.13200179 06	DXT	-.88786992 00	DYT	-.44444962 00	DZT	-.98093580-01
RS	.14893789 09	VS	.29916723 02	RM	.39218746 06	VM	.99773283 00	RT	.39218746 06	VT	.99773283 00
GED	.16343319 02	ALT	.30434052 06	LOS	.29622040 03	RAS	.20485044 03	RAM	.12235337 03	LOM	.21372333 03
DUT	.34000000 02	DT	.19200000 04	DR	.10543616 01	SHA	-.30155676 06	DES	-.10327773 02	DEM	.19668541 02

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.13275507 09	Y	.67352606 08	Z	-.72887500 04	DX	-.14717213 02	DY	.27183362 02	DZ	.12204277 00
R	.14886330 09	LAT	-.28053562-02	LON	.26900724 02	V	.30911914 02	PTH	-.15306163 01	AZ	.89773785 02
XE	.13295778 09	YE	.67117234 08	ZE	.69499999 02	DXE	-.13899802 02	DYE	.26491619 02	DZE	-.10302067-02
XT	.13276015 09	YT	.67455973 08	ZT	-.29382500 04	DXT	-.14787672 02	DYT	.26044830 02	DZT	.85789322-01
LTE	.26736357-04	LOE	.26784693 02	LTT	-.11305089-02	LOT	.26935307 02	RST	.14891463 09	VST	.29950221 02
EPS	.10383097 03	ESP	.11577320 00	SEP	.76052956 02	EPM	.13629918 03	EMP	.33186857 02	MEP	.10513961 02
MPS	.11968426 03	MSP	.34970568-01	SMP	.60281112 02	SEM	.86524320 02	EMS	.93325058 02	ESM	.15033281 00
EPT	.13629918 03	ETP	.33186857 02	TEP	.10513961 02	TPS	.11968426 03	TSP	.34970568-01	STP	.60281112 02
SET	.86524320 02	STE	.93325058 02	EST	.15033281 00	RPM	.10358258 06	RPT	.10358258 06	SPN	.10265480 03
GCE	.10524871 03	GCT	.28107799 03	SIP	.11872286 03	CPT	.78879444 02	SIN	.77918040 02	D1	.50343734 00
REP	.31071704 06	VEP	.10778769 01	CPE	.10402762 03	CPS	.93030147 02	D2	.25323148 00	D3	.48225201-02

1 DAYS 18 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437958.33333333 OCT. 20,1962 20 00 00.000

CASE 1

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.21420320 06	Y	.22705845 06	Z	.92381739 05	DX	-.77963554 00	DY	.55240036 00	DZ	.37531400 00
R	.32553485 06	DEC	.16486203 02	RA	.13333127 03	V	.10265663 01	PTH	.78182250 02	AZ	.63432220 02
R	.32553484 06	LAT	.16486204 02	LON	.16453697 03	VE	.22596951 02	PTE	.25485809 01	AZE	.27023865 03
XS	-.13275706 09	YS	-.61926991 08	ZS	-.26853097 08	DXS	.13976901 02	DYS	-.24269997 02	DZS	-.10522930 02
XM	-.21027511 06	YM	.30535994 06	ZM	.13049762 06	DXM	-.86821603 00	DYM	-.47428638 00	DZM	-.11078061 00
XT	-.21027511 06	YT	.30535994 06	ZT	.13049762 06	DXT	-.86821603 00	DYT	-.47428638 00	DZT	-.11078061 00
RS	.14893112 09	VS	.29918532 02	RM	.39 05208 06	VM	.99549937 00	RT	.39305208 06	VT	.99549937 00
GED	.16592396 02	ALT	.31915838 06	LOS	.23621326 03	RAS	.20500757 03	RAM	.12455184 03	LCM	.15575753 03
DUT	.34000000 02	DT	.19200000 04	DR	.10048072 01	SHA	-.31558460 06	DES	-.10387555 02	DEM	.19390880 02

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.13254286 09	Y	.67743520 08	Z	-.55204999 04	DX	-.14756536 02	DY	.27109184 02	DZ	.12353897 00
R	.14885158 09	LAT	-.21249444-02	LON	.27071870 02	V	.30865490 02	PTH	-.14892186 01	AZ	.89770649 02
XE	.13275706 09	YE	.67498452 08	ZE	.54499999 02	DXE	-.13976901 02	DYE	.26453068 02	DZE	-.10334253-02
XT	.13254679 09	YT	.67830522 08	ZT	-.17015000 04	DXT	-.14845117 02	DYT	.25973858 02	DZT	.86016296-01
LTE	.20966873-04	LOE	.26950415 02	LTT	-.65474976-03	LOT	.27100994 02	RST	.14889469 09	VST	.29916988 02
EPS	.10408114 03	ESP	.12134335 00	SEP	.75797383 02	EPM	.13613145 03	EMP	.35027092 02	MEP	.88414463 01
MPS	.11962556 03	MSP	.28837468-01	SMP	.60345273 02	SEM	.84607534 02	EMS	.95241885 02	ESM	.15033281 00
EPT	.13613145 03	ETP	.35027092 02	TEP	.88414463 01	TPS	.11962556 03	TSP	.28837468-01	STP	.60345273 02
SET	.84607534 02	STE	.95241885 02	EST	.15033281 00	RPM	.87174383 05	RPT	.87174383 05	SPN	.10295851 03
GCE	.10485383 03	GCT	.28095179 03	SIP	.11848318 03	CPT	.78966179 02	SIN	.77823795 02	D1	.59823039 00
REP	.32553485 06	VEP	.10265663 01	CPE	.10360708 03	CPS	.93070444 02	D2	.30114650 00	D3	.67918771-02

1 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437958.50000000 OCT. 21,1962 00 00 00.000

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.22517498 06	Y	.23481442 06	Z	.97710146 05	DX	-.74464596 00	DY	.52609707 00	DZ	.36527249 00
R	.33968935 06	DEC	.16717052 02	RA	.13379950 03	V	.98219128 00	PTH	.78465285 02	AZ	.61948998 02
R	.33968934 06	LAT	.16717052 02	LON	.10484087 03	VE	.23570164 02	PTE	.23399997 01	AZE	.27022469 03
XS	-.13255523 09	YS	-.62276235 08	ZS	-.27004524 08	DXS	.14053907 02	DYS	-.24234412 02	DZS	-.10507499 02
XM	-.22262961 06	YM	.29832038 06	ZM	.12881241 06	DXM	-.84751014 00	DYM	-.50328507 00	DZM	-.12323695 00
XT	-.22262961 06	YT	.29832038 06	ZT	.12881241 06	DXT	-.84751014 00	DYT	-.50328507 00	DZT	-.12323695 00
RS	.14892435 09	VS	.29920337 02	RM	.39389291 06	VM	.99335625 00	RT	.39389291 06	VT	.99335625 00
GED	.16824558 02	ALT	.33331293 06	LOS	.17620614 03	RAS	.20516477 03	RAM	.12673313 03	LCM	.97774507 02
DUT	.34000000 02	DT	.19200000 04	DR	.96235470 00	SHA	-.32900803 06	DES	-.10447267 02	DEM	.19088238 02

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.13233006 09	Y	.68133415 08	Z	-.37317500 04	DX	-.14798552 02	DY	.27042270 02	DZ	.12478900 00
R	.14884020 09	LAT	-.14365307-02	LON	.27242797 02	V	.30826889 02	PTH	-.14463395 01	AZ	.89768024 02
XE	.13255523 09	YE	.67879111 08	ZE	.40000000 02	DXE	-.14053907 02	DYE	.26414281 02	DZE	-.10349750-02
XT	.13233260 09	YT	.68204052 08	ZT	-.46150000 03	DXT	-.14901417 02	DYT	.25903510 02	DZT	.86123227-01
LTE	.15389230-04	LOE	.27116155 02	LTT	-.17761232-03	LOT	.27266519 02	RST	.14887481 09	VST	.29883967 02
EPS	.10427969 03	ESP	.12647557 00	SEP	.75593662 02	EPM	.13630232 03	EMP	.36568606 02	MEP	.71290734 01
MPS	.11927208 03	MSP	.22117329-01	SMP	.60704167 02	SEM	.82699712 02	EMS	.97149923 02	ESM	.15065786 00
EPT	.13630232 03	ETP	.36568606 02	TEP	.71290734 01	TPS	.11927208 03	TSP	.22117329-01	STP	.60704167 02
SET	.82699712 02	STE	.97149923 02	EST	.15065786 00	RPM	.70759003 05	RPT	.70759003 05	SPN	.10320384 03
GCE	.10448955 03	GCT	.28079476 03	SIP	.11786462 03	CPT	.79066584 02	SIN	.77659130 02	D1	.73708975 00
REP	.33968935 06	VEP	.98219128 00	CPE	.10322237 03	CPS	.93110652 02	D2	.36845586 00	D3	.10161150-01

2 DAYS 2 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437958.66666666 OCT. 21,1962 04 00 00.000

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.23566065 06	Y	.24225407 06	Z	.10292080 06	DX	-.71208346 00	DY	.50912159 00	DZ	.35930933 00
R	.35329261 06	DEC	.16936929 02	RA	.13420958 03	V	.94624037 00	PTH	.78972661 02	AZ	.59167510 02
R	.35329260 06	LAT	.16936929 02	LON	.45086694 02	VE	.24507446 02	PTE	.21718815 01	AZE	.27021703 03
XS	-.13235229 09	YS	-.62624967 08	ZS	-.27155727 08	DXS	.14130818 02	DYS	-.24198610 02	DZS	-.10491974 02
XM	-.23467861 06	YM	.29086941 06	ZM	.12694955 06	DXM	-.82579039 00	DYM	-.53142146 00	DZM	-.13545056 00
XT	-.23467861 06	YT	.29086941 06	ZT	.12694955 06	DXT	-.82579039 00	DYT	-.53142146 00	DZT	-.13545056 00
RS	.14891759 09	VS	.29922137 02	RM	.39470907 06	VM	.99130489 00	RT	.39470907 06	VT	.99130489 00
GED	.17045680 02	ALT	.34691623 06	LOS	.11619916 03	RAS	.20532205 03	RAM	.12889720 03	LOM	.39774315 02
DUT	.34000000 02	DT	.19200000 04	DR	.92876901 00	SHA	-.34195009 06	DES	-.10506908 02	DEM	.18761416 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13211663 09	Y	.68522415 08	Z	-.19260000 04	DX	-.14842902 02	DY	.26985300 02	DZ	.12607133 00
R	.14882918 09	LAT	-.74146526-03	LON	.27413553 02	V	.30798280 02	PTH	-.13988381 01	AZ	.89765409 02
XE	.13235229 09	YE	.68259211 08	ZE	.25000000 02	DXE	-.14130818 02	DYE	.26375258 02	DZE	-.10349750-02
XT	.13211761 09	YT	.68576575 08	ZT	.77874999 03	DXT	-.14956609 02	DYT	.25833814 02	DZT	.86111187-01
LTE	.96187055-05	LOE	.27281912 02	LTT	.29974867-03	LOT	.27431885 02	RST	.14885500 09	VST	.29851189 02
EPS	.10442609 03	ESP	.13140749 00	SEP	.75442261 02	EPM	.13702058 03	EMP	.37604087 02	MEP	.53753214 01
MPS	.11841364 03	MSP	.18504685-01	SMP	.61567995 02	SEM	.80800509 02	EMS	.99049515 02	ESM	.15000707 00
EPT	.13702058 03	ETP	.37604087 02	TEP	.53753214 01	TPS	.11841364 03	TSP	.18504685-01	STP	.61567995 02
SET	.80800509 02	STE	.99049515 02	EST	.15000707 00	RPM	.54238333 05	RPT	.54238333 05	SPN	.10339168 03
GCE	.10415051 03	GCT	.28057307 03	SIP	.11657735 03	CPT	.79205029 02	SIN	.77368744 02	C1	.96180665 00
REP	.35329261 06	VEP	.94624037 00	CPE	.10286829 03	CPS	.93150789 02	D2	.47096715 00	D3	.16695086-01

2 DAYS 6 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437958.83333333 OCT. 21,1962 08 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.24569539 06	Y	.24955674 06	Z	.10809615 06	DX	-.68217596 00	DY	.50934372 00	DZ	.36155659 00
R	.36650998 06	DEC	.17153562 02	RA	.13455329 03	V	.92494228 00	PTH	.79951561 02	AZ	.52934308 02
R	.36650997 06	LAT	.17153562 02	LON	.34526613 03	VE	.25425208 02	PTE	.20528253 01	AZE	.27021934 03
XS	-.13214825 09	YS	-.62973178 08	ZS	-.27306705 08	DXS	.14207634 02	DYS	-.24162591 02	DZS	-.10476357 02
XM	-.24640776 06	YM	.28301964 06	ZM	.12491264 06	DXM	-.80309559 00	DYM	-.55867235 00	DZM	-.14740975 00
XT	-.24640776 06	YT	.28301964 06	ZT	.12491264 06	DXT	-.80309559 00	DYT	-.55867235 00	DZT	-.14740975 00
RS	.14891084 09	VS	.29923932 02	RM	.39549977 06	VM	.98934672 00	RT	.39549977 06	VT	.98934672 00
GED	.17263534 02	ALT	.36013365 06	LOS	.56192243 02	RAS	.20547940 03	RAM	.13104408 03	LOM	.34175692 03
DUT	.34000000 02	DT	.24000000 03	DR	.91075423 00	SHA	-.35459829 06	DES	-.10566477 02	DEM	.18411224 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13190255 09	Y	.68910706 08	Z	-.98249999 02	DX	-.14889810 02	DY	.26947139 02	DZ	.12804592 00
R	.14881858 09	LAT	-.37826663-04	LON	.27584207 02	V	.30787516 02	PTH	-.13388989 01	AZ	.89761639 02
XE	.13214825 09	YE	.68638744 08	ZE	.97499999 01	DXE	-.14207634 02	DYE	.26335999 02	DZE	-.10337830-02
XT	.13190184 09	YT	.68948098 08	ZT	.20177500 04	DXT	-.15010730 02	DYT	.25764796 02	DZT	.85981606-01
LTE	.37514652-05	LOE	.27447685 02	LTT	.77675512-03	LOT	.27597091 02	RST	.14883526 09	VST	.29818687 02
EPS	.10451102 03	ESP	.13651968 00	SEP	.75352459 02	EPM	.13888968 03	EMP	.37540060 02	MEP	.35702625 01
MPS	.11644715 03	MSP	.13988227-01	SMP	.63539935 02	SEM	.78909586 02	EMS	.10094100 03	ESM	.14951711 00
EPT	.13888968 03	ETP	.37540060 02	TEP	.35702625 01	TPS	.11644715 03	TSP	.13988227-01	STP	.63539935 02
SET	.78909586 02	STE	.10094100 03	EST	.14951711 00	RPM	.37457540 05	RPT	.37457540 05	SPN	.10351391 03
GCE	.10383188 03	GCT	.28019734 03	SIP	.11378772 03	CPT	.79452190 02	SIN	.76792758 02	C1	.13934769 01
REP	.36650998 06	VEP	.92494228 00	CPE	.10254119 03	CPS	.93190866 02	D2	.64710830 00	D3	.32214851-01

2 DAYS 10 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.00000000 OCT. 21,1962 12 00 00.000

CASE 1 SPACE TRAJECTORIES 9

RA-5 PCSTMIDCOURSE ORBIT

GECCENTRIC EQUATORIAL COORDINATES

X	-.25534162 C6	Y	.25715857 06	Z	.11345390 06	DX	-.66079775 CC	DY	.56362491 00	DZ	.39161950 CO
R	.37973893 06	DEC	.17383630 02	RA	.13479687 C3	V	.95272899 CO	PTH	.81812717 02	AZ	.3194154C 02
R	.37973893 06	LAT	.17383630 02	LON	.28534545 03	VE	.26371570 C2	PTE	.20492702 C1	AZE	.27025C3C C3
XS	-.13194310 C9	YS	-.63320869 08	ZS	-.27457458 C8	DXS	.14284353 C2	DYS	-.24126354 C2	DZS	-.10460648 02
XM	-.25780333 06	YM	.27478396 06	ZM	.12270542 06	DXM	-.77946428 CC	DYM	-.585C1615 00	DZM	-.1591C346 00
XT	-.25780333 C6	YT	.27478396 06	ZT	.12270542 C6	DXT	-.77946428 CC	DYT	-.585C1615 CO	DZT	-.15910346 CC
RS	.14890408 09	VS	.29925722 02	RM	.39626430 06	VM	.98748285 CC	RT	.39626430 06	VT	.98748285 CO
GED	.17494891 C2	ALT	.37336265 06	LOS	.3561854C C3	RAS	.2C563683 C3	RAM	.13317384 03	LOM	.28372242 03
DLT	.34000000 02	DT	.48000000 03	DR	.94301866 CC	SHA	-.36740901 C6	DES	-.10625975 02	DEM	.18038469 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13168776 C9	Y	.69298778 C8	Z	.177875CC C4	DX	-.14945151 C2	DY	.26969404 C2	DZ	.134C3547 C0
R	.14880855 09	LAT	.68487234-C3	LON	.27754938 02	V	.30833817 02	PTH	-.12381630 01	AZ	.8975C859 02
XE	.13194310 C9	YE	.69017711 C8	ZE	-.45000000 C1	DXE	-.14284353 C2	DYE	.26296503 C2	DZE	-.10310411-02
XT	.1316853C C9	YT	.69318629 08	ZT	.32547500 C4	DXT	-.15C63818 C2	DYT	.25696479 C2	DZT	.85736273-C1
LTE	-.17315240-05	LOE	.27613476 C2	LTT	.12531173-C2	LOT	.27762143 C2	RST	.14881562 C9	VST	.29786490 02
EPS	.10449909 03	ESP	.14110C97 CO	SEP	.75359447 02	EPM	.14462847 C3	EMP	.33692480 C2	MEP	.16790261 01
MPS	.11062726 C3	MSP	.27453512-18	SMP	.69365505 02	SEM	.77026594 C2	EMS	.10282473 03	ESM	.14853236 0C
EPT	.14462847 03	ETP	.3369248C 02	TEP	.16790261 C1	TPS	.11062726 C3	TSP	.27453512-18	STP	.69365505 C2
SET	.77026594 02	STE	.1C282473 03	EST	.14853236 CC	RPM	.20057534 05	RPT	.20057534 C5	SPN	.10353672 03
GCE	.10352703 03	GCT	.27929582 C3	SIP	.10565631 C3	CPT	.8C16618C C2	SIN	.75195225 02	D1	.26C93363 C1
REP	.37973893 06	VEP	.95272899 00	CPE	.10223865 C3	CPS	.93230917 C2	D2	.99692766 00	C3	.85462581-C1

SELENOCENTRIC EQUATORIAL COORDINATES

X	.24617C98 C4	Y	-.17625384 C5	Z	-.92515140 C4	DX	.11866652 CO	DY	.11486411 C1	DZ	.55072296 00
R	.20057534 C5	CEC	-.27467722 02	RA	.27795098 03	V	.12793568 C1	PTH	-.7745528C 02	AZ	.95887709 02
R	.20057532 C5	LAT	-.35432553 01	LON	.33319562 C3	VR	.12690395 C1	PTR	-.79757036 02	AZR	.10288946 03
LTS	.15317211 01	LNS	.26398C60 03	LTE	-.67188314 00	LNE	.67924758 C1				
ALT	.18319534 C5	SHA	-.18770794 C5	ALP	.159C8C84 01	DR	-.12488144 C1	DP	.79377910-03	ASD	.49709553 01
HGE	.25550091 03	SVL	-.3959511C 01	HNG	.11C67888 03	SIA	.13965751 C3				

2 DAYS 1C HRS. 33 MIN. 52.CCC SEC. JULIAN CATE 2437959.C2083333 OCT. 21,1962 12 30 C0.CCC

GECCENTRIC EQUATCRIAL COORDINATES

X	-.2565308З C6	Y	.25818874 C6	Z	.11416732 06	DX	-.66080198 CO	DY	.58185001 00	DZ	.40153546 CO
R	.38144943 C6	CEC	.17415486 C2	RA	.13481545 03	V	.96769799 CC	PTH	.82C55848 C2	AZ	.26013437 02
R	.38144943 06	LAT	.17415486 02	LON	.27784350 C3	VE	.26499594 C2	PTE	.20726687 C1	AZE	.27026C04 C3
XS	-.13191738 09	YS	-.63364294 08	ZS	-.27476286 C8	DXS	.14293936 C2	DYS	-.24121809 C2	DZS	-.10458677 02
XM	-.25920365 06	YM	.27372802 C6	ZM	.12241773 06	DXM	-.77644644 CC	DYM	-.58824432 CO	DZM	-.16054597 00
XT	-.25920365 C6	YT	.27372802 06	ZT	.12241773 06	DXT	-.77644644 CC	DYT	-.58824432 00	DZT	-.16054597 OC
RS	.14890324 09	VS	.29925945 02	RM	.3963580C C6	VM	.98725653 00	RT	.39635800 06	VT	.98725653 CC
GED	.17526925 02	ALT	.37507315 C6	LOS	.34868456 03	RAS	.2C565651 C3	RAM	.13343886 C3	LOM	.27646691 C3
DUT	.34000000 02	DT	.24000CCC 03	DR	.95841125 00	SHA	-.36908529 C6	DES	-.10633407 02	DEM	.17990329 02

CASE 1 SPACE TRAJECTORIES 10

RA-5 PCSTMICCOURSE ORBIT

HELICCENTRIC ECLIPTIC COORDINATES

X	.13166085 C9	Y	.69347338 08	Z	.2C215CCC C4	DX	-.14954738 C2	DY	.26985117 02	DZ	.13588262 CC
R	.14880737 C9	LAT	.77834462-03	LON	.277763C9 C2	V	.3C852215 C2	PTH	-.12182206 01	AZ	.89747576 C2
XE	.13191738 C9	YE	.69065C41 C8	ZE	-.62500CCC 01	DXE	-.14293936 C2	DYE	.26291550 C2	DZE	-.103C5643-02
XT	.13165818 C9	YT	.69364877 08	ZT	.34090CCC C4	DXT	-.15070383 C2	DYT	.25687990 02	DZT	.85697531-01
LTE	-.24049081-05	LOE	.276342CC 02	LTT	.13 25269-02	LCT	.27782763 C2	RST	.14881318 C9	VST	.29782488 C2
EPS	.10448575 C3	ESP	.14196504 00	SEP	.75372132 02	EPM	.14618239 C3	EMP	.32385755 C2	MEP	.14318162 01
MPS	.1C905111 C3	MSP	.27453512-18	SMP	.7C942406 02	SEM	.76791760 C2	EMS	.10305967 C3	ESM	.14853236 00
EPT	.14618239 03	ETP	.32385755 02	TEP	.14318162 C1	TPS	.1C905111 C3	TSP	.27453512-18	STP	.70942406 02
SET	.76791760 C2	STE	.1C3C5967 C3	EST	.14853236 CC	RPM	.17795574 C5	RPT	.17795574 05	SPN	.1035277C C3
GCE	.10348914 C3	GCT	.27907311 03	SIP	.10344640 C3	CPT	.8C372334 C2	SIN	.74767621 02	D1	.2944C162 C1
REP	.38144943 06	VEP	.96769799 C0	CPE	.10220240 C3	CPS	.93235926 C2	D2	.10539744 C1	D3	.99803861-01

SELENOCENTRIC EQUATORIAL COORDINATES

X	.26728188 C4	Y	-.15539281 05	Z	-.825C4097 C4	DX	.11564446 CC	DY	.117C0943 01	DZ	.56208143 C0
R	.17795574 C5	DEC	-.27621C41 02	RA	.27975960 C3	V	.13C32382 C1	PTH	-.76079403 C2	AZ	.9503531C 02
R	.17795571 05	LAT	-.38334CC1 C1	LON	.33450895 03	VR	.12928647 C1	PTR	-.78074721 02	AZR	.10213564 03
LTS	.15318885 C1	LNS	.26372672 C3	LTE	-.70118807 CC	LNE	.67728898 C1				
ALT	.16C57574 C5	SHA	-.16820213 05	ALP	.15466003 C1	DR	-.12649622 C1	DP	.10094582-02	ASD	.56047123 01
HGE	.25551424 03	SVL	-.41737125 01	HNG	.1C910374 C3	SIA	.14C57768 03				

2 DAYS 11 HRS. 3 MIN. 52.CCO SEC. JULIAN DATE 2437959.04166666 OCT. 21,1962 13 CC C0.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.25772171 06	Y	.25925690 06	Z	.11490148 06	DX	-.66283103 CC	DY	.60624772 CC	DZ	.41489781 CO
R	.38319312 06	DEC	.17448753 C2	RA	.13482986 C3	V	.98945513 CC	PTH	.82231008 C2	AZ	.18605884 02
R	.38319313 06	LAT	.17448753 02	LON	.27C33737 03	VE	.26632783 02	PTE	.21C95765 C1	AZE	.27027289 03
XS	-.13189164 C9	YS	-.634C7712 08	ZS	-.27495111 C8	DXS	.14303518 C2	DYS	-.24117261 02	DZS	-.10456706 02
XM	-.26059854 06	YM	.27266628 06	ZM	.12212745 06	DXM	-.77341463 CC	DYM	-.59145796 CC	DZM	-.16198415 00
XT	-.26C59854 C6	YT	.27266628 C6	ZT	.12212745 06	DXT	-.77341463 CC	DYT	-.59145796 00	DZT	-.16198415 00
RS	.14890240 09	VS	.29926169 02	RM	.39645127 06	VM	.98703169 CC	RT	.39645127 06	VT	.98703169 00
GED	.17560377 C2	ALT	.37681686 C6	LOS	.34118371 03	RAS	.2C56762C C3	RAM	.13370362 03	LCM	.26921113 C3
DUT	.340C0CCC 02	DT	.24000000 03	DR	.98037308 CC	SHA	-.3708C1C2 C6	DES	-.10640839 C2	DEM	.17941850 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13163392 C9	Y	.69395933 C8	Z	.226825C0 04	DX	-.14966349 C2	DY	.27CC7859 02	DZ	.13843644 CC
R	.14880619 C9	LAT	.87335845-03	LON	.27797696 C2	V	.30877746 C2	PTH	-.11952225 01	AZ	.89743046 02
XE	.13189164 C9	YE	.69112364 C8	ZE	-.825C0CCC C1	DXE	-.143C3518 C2	DYE	.26286592 C2	DZE	-.1030C875-02
XT	.13163104 C9	YT	.69411111 08	ZT	.35630CC0 04	DXT	-.15076932 C2	DYT	.25679512 C2	DZT	.85657118-01
LTE	-.31744967-05	LOE	.27654927 02	LTT	.13718423-02	LOT	.27803382 C2	RST	.14881073 09	VST	.29778491 02
EPS	.10446818 03	ESP	.14248096 00	SEP	.75389C46 C2	EPM	.14819429 C3	EMP	.30624883 02	MEP	.11808046 01
MPS	.10700334 03	MSP	.27453512-18	SMP	.72990949 02	SEM	.76557044 C2	EMS	.10329449 03	ESM	.14803752 00
EPT	.14819429 03	ETP	.30624883 C2	TEP	.118C8C46 01	TPS	.10700334 C3	TSP	.27453512-18	STP	.72990949 02
SET	.76557044 02	STE	.10329449 03	EST	.14803752 00	RPM	.15501679 C5	RPT	.15501679 05	SPN	.10351449 03
GCE	.10345100 03	GCT	.27879201 03	SIP	.10056598 C3	CPT	.8C649577 C2	SIN	.74212617 02	D1	.33848479 C1
REP	.38319312 06	VEP	.98945513 00	CPE	.10216641 C3	CPS	.93240936 02	D2	.11020568 01	D3	.11682651 00

```
CASE  1                                   SPACE TRAJECTORIES                                                  11

RA-5  POSTMIDCOURSE ORBIT

SELENOCENTRIC                                                                              EQUATORIAL COORDINATES

    X  .28768223 04     Y -.13409374 05     Z -.72259707 04    DX  .11058359 00    DY  .11977057 01    DZ  .57688197 00
    R  .15501679 05   DEC -.27784101 02    RA  .28210858 03     V  .13339867 01   PTH -.74334340 02    AZ  .93930737 02
    R  .15501677 05   LAT -.42042444 01   LON  .33629232 03    VR  .13236410 01   PTR -.76019829 02   AZR  .10146401 03
  LTS  .15320550 01   LNS  .26347282 03   LTE -.73046653 00   LNE  .67531860 01
  ALT  .13763679 05   SHA -.14823613 05   ALP  .14678711 01    DR -.12844341 01    DP  .13313632-02   ASD  .64373601 01
  HGE  .25553181 03   SVL -.44549149 01   HNG  .10705644 03   SIA  .14175693 03

   2 DAYS 11 HRS. 33 MIN. 52.000 SEC.            JULIAN DATE 2437959.0625000           OCT. 21,1962   13 30 00.000

GEOCENTRIC                                                                                 EQUATORIAL COORDINATES

    X -.25891922 06     Y  .26037677 06     Z  .11566412 06    DX -.66856442 00    DY  .63998190 00    DZ  .43359777 00
    R  .38498495 06   DEC  .17483914 02    RA  .13483918 03     V  .10220383 01   PTH  .82268300 02    AZ  .95481553 01
    R  .38498496 06   LAT  .17483913 02   LON  .26282616 03    VE  .26773282 02   PTE  .21678303 01   AZE  .27029038 03
   XS -.13186588 09    YS -.63451119 08    ZS -.27513932 08   DXS  .14313098 02   DYS -.24112709 02   DZS -.10454733 02
   XM -.26198795 06    YM  .27159877 06    ZM  .12183459 06   DXM -.77036895 00   DYM -.59465703 00   DZM -.16341798 00
   XT -.26198795 06    YT  .27159877 06    ZT  .12183459 06   DXT -.77036895 00   DYT -.59465703 00   DZT -.16341798 00
   RS  .14890155 09    VS  .29926392 02    RM  .39654412 06    VM  .98680834 00    RT  .39654412 06    VT  .98680834 00
  GED  .17595733 02   ALT  .37860869 06   LOS  .33368286 03   RAS  .20569589 03   RAM  .13396811 03   LOM  .26195509 03
  CUT  .34000000 02    DT  .24000000 03    DR  .10127469 01   SHA -.37257235 06   DES -.10648268 02   DEM  .17893034 02

HELIOCENTRIC                                                                                 ECLIPTIC COORDINATES

    X  .13160696 09     Y  .69444576 08     Z  .25210000 04    DX -.14981662 02    DY  .27041287 02    DZ  .14217281 00
    R  .14880504 09   LAT  .97068384-03   LON  .27819104 02     V  .30914424 02   PTH -.11686078 01    AZ  .89736425 02
   XE  .13186588 09    YE  .65159676 08    ZE -.97499999 01   DXE -.14313098 02   DYE  .26281631 02   DZE -.10296106-02
   XT  .13160390 09    YT  .69457326 08    ZT  .37177500 04   DXT -.15083467 02   DYT  .25671045 02   DZT  .85614800-01
  LTE -.37516993-05   LCE  .27675652 02   LTT  .14314484-02   LOT  .27823997 02   RST  .14880828 09   VST  .29774500 02
  EPS  .10444539 03   ESP  .14299503 00   SEP  .75411155 02   EPM  .15090609 03   EMP  .28168662 02   MEP  .92524431 00
  MPS  .10422657 03   MSP  .27453512-18   SMP  .75768518 02   SEM  .76322445 02   EMS  .10352920 03   ESM  .14820265 00
  EPT  .15090609 03   ETP  .28168662 02   TEP  .92524431 00   TPS  .10422657 03   TSP  .27453512-18   STP  .75768518 02
  SET  .76322445 02   STE  .10352920 03   EST  .14820265 00   RPM  .13169090 05   RPT  .13169090 05   SPN  .10349613 03
  GCE  .10341240 03   GCT  .27842276 03   SIP  .96642786 02   CPT  .81044269 02   SIN  .73460490 02    D1  .39942089 01
  REP  .38498495 06   VEP  .10220383 01   CPE  .10213057 03   CPS  .93245948 02    D2  .11161286 01    D3  .13487455 00

SELENOCENTRIC                                                                              EQUATORIAL COORDINATES

    X  .30687270 04     Y -.11221996 05     Z -.61704664 04    DX  .10180453 00    DY  .12346389 01    DZ  .59701575 00
    R  .13169090 05   DEC -.27940656 02    RA  .28529399 03     V  .13751819 01   PTH -.72031100 02    AZ  .92432382 02
    R  .13169088 05   LAT -.46964500 01   LON  .33880332 03    VR  .13649690 01   PTR -.73403735 02   AZR  .10082346 03
  LTS  .15322223 01   LNS  .26321893 03   LTE -.75971681 00   LNE  .67333823 01
  ALT  .11431090 05   SHA -.12764936 05   ALP  .13246341 01    DR -.13081062 01    DP  .18457935-02   ASD  .75837775 01
  HGE  .25555461 03   SVL -.48362562 01   HNG  .10427847 03   SIA  .14332231 03

   2 DAYS 12 HRS.  3 MIN. 52.000 SEC.            JULIAN DATE 2437959.0833333           OCT. 21,1962   14 00 00.000
```

CASE 1 SPACE TRAJECTORIES 12

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26013296 06	Y	.26156981 06	Z	.11646773 06	DX	-.68183403 00	DY	.68886061 00	DZ	.46124649 00
R	.38684965 06	DEC	.17521710 02	RA	.13484220 03	V	.10733941 01	PTH	.82071637 02	AZ	.35911024 03
R	.38684965 06	LAT	.17521710 02	LON	.25530864 03	VE	.26924386 02	PTE	.22629629 01	AZE	.27031528 03
XS	-.13184011 09	YS	-.63494520 08	ZS	-.27532749 08	DXS	.14322677 02	DYS	-.24108154 02	DZS	-.10452758 02
XM	-.26337186 06	YM	.27052552 06	ZM	.12153915 06	DXM	-.76730946 00	DYM	-.59784150 00	DZM	-.16484743 00
XT	-.26337186 06	YT	.27052552 06	ZT	.12153915 06	DXT	-.76730946 00	DYT	-.59784150 00	DZT	-.16484743 00
RS	.14890071 09	VS	.29926615 02	RM	.39663655 06	VM	.98658650 00	RT	.39663655 06	VT	.98658650 00
GED	.17633741 02	ALT	.38047341 06	LOS	.32618202 03	RAS	.20571557 03	RAM	.13423234 03	LOM	.25465878 03
DUT	.34000000 02	DT	.12000000 03	DR	.10631339 01	SHA	-.37442558 06	DES	-.10655698 02	DEM	.17843884 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13157998 09	Y	.69493295 08	Z	.27812500 04	DX	-.15004511 02	DY	.27092166 02	DZ	.14809453 00
R	.14880393 09	LAT	.10708984-02	LON	.27840544 02	V	.30970029 02	PTH	-.11385259 01	AZ	.89725942 02
XE	.13184011 09	YE	.69206981 08	ZE	-.12000000 02	DXE	-.14322677 02	DYE	.26276666 02	DZE	-.10290146-02
XT	.13157674 09	YT	.69503529 08	ZT	.38715000 04	DXT	-.15089986 02	DYT	.25662590 02	DZT	.85570931-01
LTE	-.46175021-05	LOE	.27696379 02	LTT	.14906713-02	LOT	.27844610 02	RST	.14880584 09	VST	.29770514 02
EPS	.10441604 03	ESP	.14452625 00	SEP	.75439791 02	EPM	.15476952 03	EMP	.24566090 02	MEP	.66433406 00
MPS	.10022586 03	MSP	.27453512-18	SMP	.79770051 02	SEM	.76087964 02	EMS	.10376379 03	ESM	.14820265 00
EPT	.15476952 03	ETP	.24566090 02	TEP	.66433406 00	TPS	.10022586 03	TSP	.27453512-18	STP	.79770051 02
SET	.76087964 02	STE	.10376379 03	EST	.14820265 00	RPM	.10789550 05	RPT	.10789550 05	SPN	.10347136 03
GCE	.10337296 03	GCT	.27790884 03	SIP	.90956165 02	CPT	.81647580 02	SIN	.72377887 02	D1	.48963952 01
REP	.38684965 06	VEP	.10733941 01	CPE	.10209465 03	CPS	.93250966 02	D2	.10199183 01	D3	.14422220 00

SELENOCENTRIC EQUATORIAL COORDINATES

X	.32388966 04	Y	-.89557038 04	Z	-.50714216 04	DX	.85475419-01	DY	.12867021 01	DZ	.62609392 00
R	.10789550 05	DEC	-.28036300 02	RA	.28988290 03	V	.14334929 01	PTH	-.68816898 02	AZ	.90271257 02
R	.10789549 05	LAT	-.53835934 01	LON	.34253873 03	VR	.14235530 01	PTR	-.69874455 02	AZR	.10013494 03
LTS	.15323879 01	LNS	.26296505 03	LTE	-.78894063 00	LNE	.67134671 01				
ALT	.90515504 04	SHA	-.10618028 05	ALP	.10484553 01	DR	-.13366324 01	DP	.27506941-02	ASD	.92696927 01
HGE	.25558396 03	SVL	-.53770672 01	HNG	.10027155 03	SIA	.14549983 03				

2 DAYS 12 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.10416666 OCT. 21,1962 14 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26138417 06	Y	.26287256 06	Z	.11733446 06	DX	-.71298918 00	DY	.76468049 00	DZ	.50565585 00
R	.38883292 06	DEC	.17563380 02	RA	.13483733 03	V	.11613689 01	PTH	.81577776 02	AZ	.34861277 03
R	.38883292 06	LAT	.17563380 02	LON	.24778324 03	VE	.27090847 02	PTE	.24304750 01	AZE	.27035299 03
XS	-.13181432 09	YS	-.63537911 08	ZS	-.27551563 08	DXS	.14332253 02	DYS	-.24103595 02	DZS	-.10450782 02
XM	-.26475025 06	YM	.26944654 06	ZM	.12124114 06	DXM	-.76423623 00	DYM	-.60101132 00	DZM	-.16627248 00
XT	-.26475025 06	YT	.26944654 06	ZT	.12124114 06	DXT	-.76423623 00	DYT	-.60101132 00	DZT	-.16627248 00
RS	.14889986 09	VS	.29926838 02	RM	.39672856 06	VM	.98636614 00	RT	.39672856 06	VT	.98636614 00
GED	.17675643 02	ALT	.38245668 06	LOS	.31868117 03	RAS	.20573526 03	RAM	.13449631 03	LOM	.24744222 03
DUT	.34000000 02	DT	.12000000 03	DR	.11 88442 01	SHA	-.37640810 06	DES	-.10663126 02	DEM	.17794400 02

CASE 1 SPACE TRAJECTORIES 13

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13155294 09	Y	.69542129 08	Z	.30567500 04	DX	-.15045242 02	DY	.27174427 02	DZ	.15867519 00
R	.14880283 09	LAT	.11769861-02	LON	.27862033 02	V	.31061776 02	PTH	-.11092449 01	AZ	.89707232 02
XE	.13181432 09	YE	.69254275 08	ZE	-.13500000 02	DXE	-.14332253 02	DYE	.26271698 02	DZE	-.10285377-02
XT	.13154957 09	YT	.69549716 08	ZT	.40255000 04	DXT	-.15096490 02	DYT	.25654147 02	DZT	.85525034-01
LTE	-.51947193-05	LOE	.27717104 02	LTT	.15499925-02	LOT	.27865222 02	RST	.14880340 09	VST	.29766534 02
EPS	.10437833 03	ESP	.14503307 00	SEP	.75476732 02	EPM	.16070738 03	EMP	.18893939 02	MEP	.39854255 00
MPS	.93906377 02	MSP	.27453512-18	SMP	.86090411 02	SEM	.75853598 02	EMS	.10399827 03	ESM	.14803752 00
EPT	.16070738 03	ETP	.18893939 02	TEP	.39854255 00	TPS	.93906377 02	TSP	.27453512-18	STP	.86090411 02
SET	.75853598 02	STE	.10399827 03	EST	.14803752 00	RPM	.83552303 04	RPT	.83552303 04	SPN	.10343847 03
GCE	.10333187 03	GCT	.27712471 03	SIP	.81900417 02	CPT	.82679988 02	SIN	.70674028 02	C1	.63799578 01
REP	.38883292 06	VEP	.11613689 01	CPE	.10205811 03	CPS	.93255989 02	D2	.53690930 00	C3	.92725186-01

SELENOCENTRIC EQUATORIAL COORDINATES

X	.33660844 04	Y	-.65739795 04	Z	-.39066795 04	DX	.51247050-01	DY	.13656918 01	DZ	.67192833 00
R	.83552303 04	DEC	-.27876864 02	RA	.29711387 03	V	.15229012 01	PTH	-.63939563 02	AZ	.86873429 02
R	.83552293 04	LAT	-.64114609 01	LON	.34860281 03	VR	.15134379 01	PTR	-.64681985 02	AZR	.99225567 02
LTS	.15325553 01	LNS	.26271113 03	LTE	-.81813542 00	LNE	.66934201 01				
ALT	.66172303 04	SHA	-.83357866 04	ALP	.45563965 00	DR	-.13680696 01	DP	.45879200-02	ASD	.12005959 02
HGE	.25562166 03	SVL	-.61926788 01	HNG	.93929341 02	SIA	.14870142 03				

2 DAYS 13 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.1250000 OCT. 21,1962 15 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26273023 06	Y	.26435405 06	Z	.11830943 06	DX	-.79816640 00	DY	.89385722 00	DZ	.58673036 00
R	.39103371 06	DEC	.17611161 02	RA	.13482348 03	V	.13342799 01	PTH	.81062072 02	AZ	.34202373 03
R	.39103371 06	LAT	.17611161 02	LON	.24024886 03	VE	.27274754 02	PTE	.27699499 01	AZE	.27041470 03
XS	-.13178851 09	YS	-.63581296 08	ZS	-.27570374 08	DXS	.14341829 02	DYS	-.24099033 02	DZS	-.10448804 02
XM	-.26612311 06	YM	.26836188 06	ZM	.12094057 06	DXM	-.76114934 00	DYM	-.60416646 00	DZM	-.16769313 00
XT	-.26612311 06	YT	.26836188 06	ZT	.12094057 06	DXT	-.76114934 00	DYT	-.60416646 00	DZT	-.16769313 00
RS	.14889902 09	VS	.29927060 02	RM	.39682014 06	VM	.98614725 00	RT	.39682014 06	VT	.98614725 00
GED	.17723689 02	ALT	.38465748 06	LOS	.31118033 03	RAS	.20575496 03	RAM	.13476001 03	LOM	.24018538 03
DUT	.34000000 02	DT	.12000000 03	DR	.13180781 01	SHA	-.37861869 06	DES	-.10670553 02	DEM	.17744583 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13152578 09	Y	.69591163 08	Z	.33595000 04	DX	-.15139995 02	DY	.27320223 02	DZ	.18166757 00
R	.14880175 09	LAT	.12935678-02	LON	.27883612 02	V	.31235348 02	PTH	-.11101798 01	AZ	.89666672 02
XE	.13178851 09	YE	.69301562 08	ZE	-.16000000 02	DXE	-.14341829 02	DYE	.26266726 02	DZE	-.10279417-02
XT	.13152239 09	YT	.69595888 08	ZT	.41790000 04	DXT	-.15102978 02	DYT	.25645715 02	DZT	.85477590-01
LTE	-.61567391-05	LOE	.27737831 02	LTT	.16091230-02	LOT	.27885830 02	RST	.14880096 09	VST	.29762559 02
EPS	.10433059 03	ESP	.14553811 00	SEP	.75523621 02	EPM	.17005297 03	EMP	.98005373 01	MEP	.14604142 00
MPS	.82272548 02	MSP	.27453512-18	SMP	.97725208 02	SEM	.75619348 02	EMS	.10423264 03	ESM	.14770671 00
EPT	.17005297 03	ETP	.98005373 01	TEP	.14604142 00	TPS	.82272548 02	TSP	.27453512-18	STP	.97725208 02
SET	.75619348 02	STE	.10423264 03	EST	.14770671 00	RPM	.58734272 04	RPT	.58734272 04	SPN	.10339602 03
GCE	.10328723 03	GCT	.27570315 03	SIP	.65060496 02	CPT	.84798198 02	SIN	.67586146 02	D1	.92934676 01
REP	.39103371 06	VEP	.13342799 01	CPE	.10201928 03	CPS	.93261021 02	D2	.16883718 01	C3	.39053930 00

CASE 1 SPACE TRAJECTORIES 14

RA-5 POSTMIDCOURSE ORBIT

SELENOCENTRIC EQUATORIAL COORDINATES

X	.33928748 04	Y	-.40078208 04	Z	-.26311443 04	DX	-.37017064-01	DY	.14980237 01	DZ	.75442349 00
R	.58734272 04	DEC	-.26613790 02	RA	.31025003 03	V	.16776770 01	PTH	-.55435359 02	AZ	.80835820 02
R	.58734264 04	LAT	-.80876696 01	LON	.43521964-01	VR	.16690163 01	PTR	-.55869289 02	AZR	.97558618 02
LTS	.15327192 01	LNS	.26245724 03	LTE	-.84730289 00	LNE	.66732924 01				
ALT	.41354272 04	SHA	.58201207 04	ALP	.10969114 01	DR	-.13815446 01	DP	.92849468-02	ASD	.17212052 02
HGE	.25566940 03	SVL	-.75148080 01	HNG	.82205188 02	SIA	.15284091 03				

2 DAYS 13 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.14583333 OCT. 21,1962 15 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26438701 06	Y	.26614925 06	Z	.11950011 06	DX	-.11213875 01	DY	.11140224 01	DZ	.75748619 00
R	.39372095 06	DEC	.17668828 02	RA	.13480968 03	V	.17528095 01	PTH	.82056595 02	AZ	.24745224 01
R	.39372094 06	LAT	.17668828 02	LON	.23271453 03	VE	.27401870 02	PTE	.36322929 01	AZE	.27050704 03
XS	-.13176269 09	YS	-.63624671 08	ZS	-.27589181 08	DXS	.14351403 02	DYS	-.24094468 02	DZS	-.10446826 02
XM	-.26749038 06	YM	.26727155 06	ZM	.12063745 06	DXM	-.75804888 00	DYM	-.60730687 00	DZM	-.16910933 00
XT	-.26749038 06	YT	.26727155 06	ZT	.12063745 06	DXT	-.75804888 00	DYT	-.60730687 00	DZT	-.16910933 00
RS	.14889818 09	VS	.29927284 02	RM	.39691130 06	VM	.98592986 00	RT	.39691130 06	VT	.98592986 00
GED	.17781676 02	ALT	.38734473 06	LOS	.30367949 03	RAS	.20577465 03	RAM	.13502344 03	LOM	.23292829 03
DUT	.34000000 02	DT	.59999999 02	DR	.17359914 01	SHA	-.38130574 06	DES	-.10677977 02	DEM	.17694437 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13149830 09	Y	.69640560 08	Z	.37360000 04	DX	-.15472790 02	DY	.27585172 02	DZ	.25074065 00
R	.14880057 09	LAT	.14385497-02	LON	.27905373 02	V	.31629287 02	PTH	-.13830587 01	AZ	.89545617 02
XE	.13176269 09	YE	.69348839 08	ZE	-.17500000 02	DXE	-.14351403 02	DYE	.26261751 02	DZE	-.10274649-02
XT	.13149520 09	YT	.69642043 08	ZT	.43332500 04	DXT	-.15109451 02	DYT	.25637295 02	DZT	.85427998-01
LTE	-.67339717-05	LOE	.27758558 02	LTT	.16685443-02	LOT	.27906437 02	RST	.14879852 09	VST	.29758590 02
EPS	.10427991 03	ESP	.14670980 00	SEP	.75573262 02	EPM	.15596010 03	EMP	.23834629 02	MEP	.20498850 00
MPS	.54057864 02	MSP	.27453512-18	SMP	.12594104 03	SEM	.75385213 02	EMS	.10446690 03	ESM	.14770671 00
EPT	.15596010 03	ETP	.23834629 02	TEP	.20498850 00	TPS	.54057864 02	TSP	.27453512-18	STP	.12594104 03
SET	.75385213 02	STE	.10446690 03	EST	.14770671 00	RPM	.34905655 04	RPT	.34905655 04	SPN	.10335172 03
GCE	.10323279 03	GCT	.27160051 03	SIP	.24195804 02	CPT	.90622533 02	SIN	.60760473 02	D1	.17224341 02
REP	.39372095 06	VEP	.17528095 01	CPE	.10197132 03	CPS	.93266070 02	D2	.14688999 02	D3	.71694348 01

SELENOCENTRIC EQUATORIAL COORDINATES

X	.31033774 04	Y	-.11222996 04	Z	-.11373390 04	DX	-.36333867 00	DY	.17213293 01	DZ	.92659552 00
R	.34905655 04	DEC	-.19016006 02	RA	.34011807 03	V	.19883583 01	PTH	-.36345215 02	AZ	.68999417 02
R	.34905649 04	LAT	-.10647152 02	LON	.28532108 02	VR	.19810168 01	PTR	-.36501597 02	AZR	.92669034 02
LTS	.15328865 01	LNS	.26220334 03	LTE	-.87643877 00	LNE	.66530451 01				
ALT	.17525655 04	SHA	.28260365 04	ALP	.72315156 01	DR	-.11783986 01	DP	.26288505-01	ASD	.29862060 02
HGE	.25572008 03	SVL	-.93950958 01	HNG	.53491040 02	SIA	.12609804 03				

2 DAYS 13 HRS. 57 MIN. 35.304 SEC. JULIAN DATE 2437959.16230676 OCT. 21,1962 15 53 43.304

CASE 1 SPACE TRAJECTORIES 15

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26651531 06	Y	.26775470 06	Z	.12068760 06	DX	-.19612389 01	DY	.10016943 01	DZ	.85827348 00
R	.39659612 06	DEC	.17716569 02	RA	.13486708 03	V	.23635742 01	PTH	.72600316 02	AZ	.75204849 02
R	.39659612 06	LAT	.17716569 02	LON	.22682526 03	VE	.26960412 02	PTE	.47987901 01	AZE	.27038492 03
XS	-.13174226 09	YS	-.63658962 08	ZS	-.27604049 08	DXS	.14358971 02	DYS	-.24090856 02	DZS	-.10445260 02
XM	-.26856757 06	YM	.26640540 06	ZM	.12039596 06	DXM	-.75558771 00	DYM	-.60977963 00	DZM	-.17022601 00
XT	-.26856757 06	YT	.26640540 06	ZT	.12039596 06	DXT	-.75558771 00	DYT	-.60977963 00	DZT	-.17022601 00
RS	.14889751 09	VS	.29927460 02	RM	.39698308 06	VM	.98575903 00	RT	.39698308 06	VT	.98575903 00
GED	.17829682 02	ALT	.39021991 06	LOS	.29774839 03	RAS	.20579022 03	RAM	.13523156 03	LOM	.22718974 03
DUT	.34000000 02	DT	.59999999 02	DR	.22554217 01	SHA	-.38405133 06	DES	-.10683848 02	DEM	.17654551 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13147574 09	Y	.69679882 08	Z	.41852500 04	DX	-.16320210 02	DY	.27518275 02	DZ	.38789701 00
R	.14879905 09	LAT	.16115503-02	LON	.27922818 02	V	.31996175 02	PTH	-.27477825 01	AZ	.89304496 02
XE	.13174226 09	YE	.69386216 08	ZE	-.19250000 02	DXE	-.14358971 02	DYE	.26257814 02	DZE	-.10268688-02
XT	.13147369 09	YT	.69678528 08	ZT	.44545000 04	DXT	-.15114559 02	DYT	.25630645 02	DZT	.85387706-01
LTE	-.74074020-05	LOE	.27774947 02	LTT	.17152545-02	LOT	.27922728 02	RST	.14879660 09	VST	.29755456 02
EPS	.10430140 03	ESP	.14770671 00	SEP	.75550712 02	EPM	.98824472 02	EMP	.80822776 02	MEP	.35256216 00
MPS	.83131379 01	MSP	.98911702-02	SMP	.17168672 03	SEM	.75200155 02	EMS	.10465205 03	ESM	.14737516 00
EPT	.98824472 02	ETP	.80822776 02	TEP	.35256216 00	TPS	.83131379 01	TSP	.98911702-02	STP	.17168672 03
SET	.75200155 02	STE	.10465205 03	EST	.14737516 00	RPM	.24733479 04	RPT	.24733479 04	SPN	.10337994 03
GCE	.10316860 03	GCT	.15265243 03	SIP	-.36330180 02	CPT	.10064119 03	SIN	.55997863 02	D1	.29628798 02
REP	.39659612 06	VEP	.23635742 01	CPE	.10190601 03	CPS	.93270063 02	D2	.23218171 02	D3	.20026002 03

SELENOCENTRIC EQUATORIAL COORDINATES

X	.20522633 04	Y	.13493010 04	Z	.29163704 03	DX	-.12056512 01	DY	.16114740 01	DZ	.10284995 01
R	.24733479 04	DEC	.67716065 01	RA	.33323707 02	V	.22601448 01	PTH	-.17093266-04	AZ	.62725377 02
R	.24733475 04	LAT	-.77901483 01	LON	.87497005 02	VR	.22536800 01	PTR	-.17023913-04	AZR	.82230666 02
LTS	.15330172 01	LNS	.26200256 03	LTE	-.89945736 00	LNE	.66369481 01				
ALT	.73534793 03	SHA	.35761043 03	ALP	.13144334 03	DR	-.67862137-06	DP	.52356868-01	ASD	.44643324 02
HCE	.25569859 03	SVL	-.63104390 01	HNG	.35457729 03	SIA	.54181148 02				

SELENOCENTRIC CONIC CONVENTIONAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437959.16230676 OCT. 21,1962 15 53 43.305

SMA	-.42786451 04	ECC	.15780680 01	INC	.28039960 02	LAN	.20441789 02	APF	.14526641 02	RCA	.24733479 04
VH	.10702335 01	C3	.11453997 01	C1	.55901242 04	SLR	.63764592 04	APO	.00000000 00	TFP	-.59493208-03
TA	-.34150945-04	EA	-.12379718-04	MA	-.85263333-05	DAI	.25261389 02	RAI	.82813397 02	MTA	.12932261 03
WX	.16418059 00	WY	-.44048472 00	WZ	.88261995 00	PX	.82975090 00	PY	.54553661 00	PZ	.11791208 00
QX	-.53343996 00	QY	.71299580 00	QZ	.45505910 00	RX	.53386755-01	RY	.42339596 00	RZ	-.90437032 00
SXO	-.93846564 00	SYO	.20586748 00	SZO	.27730998 00	DAO	.16099720 02	RAO	.16762723 03	TF	.61959805 02
SXI	.11313782 00	SYI	.89726558 00	SZI	.42674851 00	TX	.99214398 00	TY	-.12510121 00	TZ	.00000000 00
BX	.97992070 00	BY	-.29793875-01	BZ	-.19714907 00	MX	-.53343956 00	MY	.71299607 00	MZ	.45505917 00
B.T	.50976536 04	B.R	.11386528 04	B	.52232752 04	PER	.18238294 04	DEF	.78645227 02	C3J	-.16145021 01

2 DAYS 14 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.16666666 OCT. 21,1962 16 00 00.000

CASE 1 SPACE TRAJECTORIES 16

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26729679 06	Y	.26809706 C6	Z	.12100142 06	DX	-.21744387 C1	DY	.80820910 00	DZ	.80153038 00
R	.39744804 06	DEC	.17724828 02	RA	.13491436 03	V	.24543505 C1	PTH	.66546354 02	AZ	.82835557 02
R	.39744803 C6	LAT	.1772483C 02	LON	.22529867 C3	VE	.26732609 02	PTE	.48315127 01	AZE	.27026204 03
XS	-.13173684 C9	YS	-.63668038 08	ZS	-.27607983 08	DXS	.14360975 C2	DYS	-.24089899 02	DZS	-.10444845 02
XM	-.26885208 06	YM	.26617558 06	ZM	.12033178 06	DXM	-.75493491 C0	DYM	-.61043253 00	DZM	-.17C52109 00
XT	-.26885208 C6	YT	.26617558 06	ZT	.12033178 06	DXT	-.75493491 CC	DYT	-.61043253 00	DZT	-.17C52109 CC
RS	.14889733 C9	VS	.29927506 02	RM	.39700203 06	VM	.98571396 CC	RT	.39700203 06	VT	.98571396 00
GED	.17837989 02	ALT	.39107184 C6	LOS	.29617865 C3	RAS	.20579434 03	RAM	.13528662 03	LCM	.22567093 C3
DUT	.34000000 02	DT	.59999999 02	DR	.22515780 01	SHA	-.38481305 06	DES	-.10685401 02	DEM	.17643961 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13146955 C9	Y	.69690213 08	Z	.43367500 C4	DX	-.16535413 02	DY	.27317144 02	DZ	.41281235 C0
R	.14879841 09	LAT	.16698932-02	LON	.27927450 02	V	.31934568 02	PTH	-.32593039 C1	AZ	.89258032 02
XE	.13173684 09	YE	.69396106 08	ZE	-.19500000 02	DXE	-.14360975 C2	DYE	.26256771 02	DZE	-.10265112-02
XT	.13146799 C9	YT	.69688185 08	ZT	.44867500 04	DXT	-.15115910 C2	DYT	.25628886 02	DZT	.85377096-C1
LTE	-.75036108-05	LOE	.27779284 02	LTT	.17276786-02	LOT	.27927C40 02	RST	.14879609 09	VST	.29754627 C2
EPS	.10433761 03	ESP	.14820265 00	SEP	.75514210 02	EPM	.79789184 C2	EMP	.99847038 02	MEP	.36369451 00
MPS	.24819469 02	MSP	.27453512-18	SMP	.15518C11 03	SEM	.75151189 C2	EMS	.10470104 03	ESM	.14770671 00
EPT	.79789184 02	ETP	.99847C38 02	TEP	.36369451 CC	TPS	.24819469 02	TSP	.27453512-18	STP	.15518011 C3
SET	.75151189 02	STE	.10470104 03	EST	.14770671 C0	RPM	.25611447 04	RPT	.25611447 04	SPN	.10341813 C3
GCE	.10314699 03	GCT	.11182300 C3	SIP	-.17915C84 02	CPT	.10198C45 C3	SIN	.59245896 02	D1	.27716725 02
REP	.39744804 06	VEP	.24543505 01	CPE	.10188081 03	CPS	.93271110 C2	D2	.25837627 02	D3	.55368635 02

SELENOCENTRIC EQUATORIAL COORDINATES

X	.15552925 C4	Y	.19214861 C4	Z	.66964C41 C3	DX	-.14195C38 C1	DY	.14186416 C1	DZ	.97205146 00
R	.25611447 04	DEC	.15156792 C2	RA	.51C12538 02	V	.22298922 C1	PTH	.11812186 02	AZ	.66124608 02
R	.25611442 04	LAT	-.48119527 01	LON	.10659354 C3	VR	.22233401 C1	PTR	.11847499 02	AZR	.80099692 02
LTS	.15330522 01	LNS	.26194943 03	LTE	-.90554647 CC	LNE	.66326797 C1				
ALT	.82314468 03	SHA	.10750844 C4	ALP	.17270497 C3	DR	.45646837 C0	DP	.48828897-C1	ASD	.42734557 02
HGE	.25566238 03	SVL	-.363037C2 C1	HNG	.33543C82 C3	SIA	.37054628 C2				

2 DAYS 14 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.1875CCCC OCT. 21,1962 16 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.27147336 06	Y	.26878888 C6	Z	.12211290 06	DX	-.23179320 C1	DY	.84982669-C1	DZ	.46799388 C0
R	.40106957 06	DEC	.17726166 02	RA	.13528469 03	V	.23662309 C1	PTH	.48360865 02	AZ	.92695379 C2
R	.40106956 C6	LAT	.17726167 02	LON	.21814847 C3	VE	.26346951 C2	PTE	.38485469 01	AZE	.26983885 C3
XS	-.13171C99 C9	YS	-.63711397 08	ZS	-.27626783 C8	DXS	.1437C545 C2	DYS	-.24C85328 C2	DZS	-.10442864 C2
XM	-.27020815 06	YM	.26507400 C6	ZM	.12002358 06	DXM	-.75180751 C0	DYM	-.61354339 CC	DZM	-.17192837 00
XT	-.27020815 06	YT	.26507400 06	ZT	.12002358 C6	DXT	-.75180751 CC	DYT	-.61354339 00	DZT	-.17192837 00
RS	.14889649 C9	VS	.29927729 02	RM	.39709234 C6	VM	.98549956 CC	RT	.39709234 06	VT	.98549956 CC
GED	.17839333 02	ALT	.35469337 06	LOS	.28867781 C3	RAS	.20581403 C3	RAM	.13554953 C3	LCM	.21841331 03
DUT	.34CCC000 02	DT	.59999999 02	DR	.17683895 01	SHA	-.38775838 06	DES	-.10692824 02	DEM	.17593158 02

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.13143951 09	Y	.69738548 08	Z	.50794999 04	DX	-.16688477 02	DY	.26515939 02	DZ	.39452982 00
R	.14879452 09	LAT	.19559449-02	LON	.27949311 02	V	.31332985 02	PTH	-.42356230 01	AZ	.89276420 02
XE	.13171099 09	YE	.69443365 08	ZE	-.21250000 02	DXE	-.14370545 02	DYE	.26251788 02	DZE	-.10261536-02
XT	.13144078 09	YT	.69734309 08	ZT	.46405000 04	DXT	-.15122353 02	DYT	.25620490 02	DZT	.85324048-01
LTE	-.81770582-05	LOE	.27800011 02	LTT	.17869112-02	LOT	.27947641 02	RST	.14879365 09	VST	.29750669 02
EPS	.10465351 03	ESP	.14951711 00	SEP	.75197170 02	EPM	.26403508 02	EMP	.15331122 03	MEP	.28504796 00
MPS	.78723632 02	MSP	.27453512-18	SMP	.10127469 03	SEM	.74917280 02	EMS	.10493508 03	ESM	.14770671 00
EPT	.26403508 02	ETP	.15331122 03	TEP	.28504796 00	TPS	.78723632 02	TSP	.27453512-18	STP	.10127469 03
SET	.74917280 02	STE	.10493508 03	EST	.14770671 00	RPM	.44459388 04	RPT	.44459388 04	SPN	.10374233 03
GCE	.10304068 03	GCT	.98016593 02	SIP	.55711965 02	CPT	.98494744 02	SIN	.75483077 02	D1	.12741454 02
REP	.40106957 06	VEP	.23662309 01	CPE	.10174113 03	CPS	.93276045 02	D2	.37184443 01	D3	.10788361 01

SELENOCENTRIC — EQUATORIAL COORDINATES

X	-.12652081 04	Y	.37148834 04	Z	.20893210 04	DX	-.15661244 01	DY	.69852606 00	DZ	.63992225 00
R	.44459388 04	DEC	.28030352 02	RA	.10880772 03	V	.18303510 01	PTH	.46608445 02	AZ	.89232405 02
R	.44459381 04	LAT	.52274843 01	LON	.16022589 03	VR	.18223885 01	PTR	.46873893 02	AZR	.80251984 02
LTS	.15332178 01	LNS	.26169552 03	LTE	-.93462259 00	LNE	.66122258 01				
ALT	.27079388 04	SHA	.43601372 04	ALP	.17886842 03	DR	.13300721 01	DP	.16204583-01	ASC	.23011667 02
HCE	.25534648 03	SVL	.49268638 01	HNG	.28131874 03	SIA	.33918417 01				

2 DAYS 15 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.20833333 OCT. 21,1962 17 00 00.000

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.27552655 06	Y	.26870490 06	Z	.12281552 06	DX	-.21902978 01	DY	-.13876777 00	DZ	.33328139 00
R	.40398126 06	DEC	.17698786 02	RA	.13571813 03	V	.22198508 01	PTH	.42610605 02	AZ	.94555171 02
R	.40398125 06	LAT	.17698786 02	LON	.21106138 03	VE	.26478846 02	PTE	.32536981 01	AZE	.26971878 03
XS	-.13168511 09	YS	-.63754749 08	ZS	-.27645579 08	DXS	.14380115 02	DYS	-.24080752 02	DZS	-.10440880 02
XM	-.27155858 06	YM	.26396681 06	ZM	.11971284 06	DXM	-.74866674 00	DYM	-.61663945 00	DZM	-.17333116 00
XT	-.27155858 06	YT	.26396681 06	ZT	.11971284 06	DXT	-.74866674 00	DYT	-.61663945 00	DZT	-.17333116 00
RS	.14889565 09	VS	.29927952 02	RM	.39718221 06	VM	.98528665 00	RT	.39718221 06	VT	.98528665 00
GED	.17811801 02	ALT	.39760505 06	LOS	.28117698 03	RAS	.20583373 03	RAM	.13581218 03	LOM	.21115543 03
DUT	.34000000 02	DT	.12000000 03	DR	.15028661 01	SHA	-.38987543 06	DES	-.10700247 02	DEM	.17542029 02

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.13140958 09	Y	.69786002 08	Z	.57552499 04	DX	-.16570413 02	DY	.26252078 02	DZ	.35995233 00
R	.14879034 09	LAT	.22162160-02	LON	.27970855 02	V	.31046412 02	PTH	-.42891060 01	AZ	.89333665 02
XE	.13168511 09	YE	.69490618 08	ZE	-.23500000 02	DXE	-.14380115 02	DYE	.26246801 02	DZE	-.10255575-02
XT	.13141355 09	YT	.69780421 08	ZT	.47937500 04	DXT	-.15128782 02	DYT	.25612104 02	DZT	.85269212-01
LTE	-.90429156-05	LOE	.27820740 02	LTT	.18459532-02	LOT	.27968241 02	RST	.14879122 09	VST	.29746717 02
EPS	.10503533 03	ESP	.14984393 00	SEP	.74814539 02	EPM	.10429030 02	EMP	.16939039 03	MEP	.18036143 00
MPS	.97366505 02	MSP	.27453512-18	SMP	.82630850 02	SEM	.74683481 02	EMS	.10516900 03	ESM	.14720910 00
EPT	.10429030 02	ETP	.16939039 03	TEP	.18036143 00	TPS	.97366505 02	TSP	.27453512-18	STP	.82630850 02
SET	.74683481 02	STE	.10516900 03	EST	.14720910 00	RPM	.69152626 04	RPT	.69152626 04	SPN	.10413071 03
GCE	.10294392 03	GCT	.95732673 02	SIP	.82810389 02	CPT	.95253494 02	SIN	.80697377 02	D1	.77898840 01
REP	.40398126 06	VEP	.22198508 01	CPE	.10160291 03	CPS	.93280929 02	D2	.12881459 01	D3	.26160105 00

CASE 1 SPACE TRAJECTORIES 18

RA-5 POSTMIDCOURSE ORBIT

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.39679710 04	Y	.47380871 04	Z	.31026752 04	DX	-.14416311 01	DY	.47787168 00	DZ	.50661255 00
R	.69152626 04	DEC	.26658426 02	RA	.12994492 03	V	.16010365 01	PTH	.59671726 02	AZ	.99031571 02
R	.69152614 04	LAT	.80528458 01	LON	.17866846 03	VR	.15919878 01	PTR	.60233091 02	AZR	.82356751 02
LTS	.15333834 01	LNS	.26144161 03	LTE	-.96366967 00	LNE	.65916592 01				
ALT	.51772625 04	SHA	-.68581449 04	ALP	.17895751 03	DR	.13819290 01	DP	.66983313-02	ASD	.14556116 02
HGE	.25496466 03	SVL	.71514180 01	HNG	.26257541 03	SIA	-.41270861 01				

2 DAYS 15 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.22916666 OCT. 21,1962 17 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.27938342 06	Y	.26836462 06	Z	.12335494 06	DX	-.21012034 01	DY	-.22833979 00	DZ	.27269104 00
R	.40656008 06	DEC	.17662610 02	RA	.13615243 03	V	.21310924 01	PTH	.40214306 02	AZ	.95357449 02
R	.40656007 06	LAT	.17662611 02	LON	.20397515 03	VE	.26664956 02	PTE	.29578279 01	AZE	.26967306 03
XS	-.13165922 09	YS	-.63798089 08	ZS	-.27664372 08	DXS	.14389682 02	DYS	-.24076173 02	DZS	-.10438896 02
XM	-.27290335 06	YM	.26285409 06	ZM	.11939958 06	DXM	-.74551269 00	DYM	-.61972063 00	DZM	-.17472944 00
XT	-.27290335 06	YT	.26285409 06	ZT	.11939958 06	DXT	-.74551269 00	DYT	-.61972063 00	DZT	-.17472944 00
RS	.14889480 09	VS	.29928174 02	RM	.39727166 06	VM	.98507523 00	RT	.39727166 06	VT	.98507523 00
GED	.17775425 02	ALT	.40018386 06	LOS	.27367613 03	RAS	.20585342 03	RAM	.13607457 03	LOM	.20389729 03
DUT	.34000000 02	DT	.12000000 03	DR	.13759364 01	SHA	-.39163826 06	DES	-.10707667 02	DEM	.17490576 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13137983 09	Y	.69833145 08	Z	.63845000 04	DX	-.16490886 02	DY	.26140804 02	DZ	.33999872 00
R	.14878618 09	LAT	.24585945-02	LON	.27992262 02	V	.30909651 02	PTH	-.42531647 01	AZ	.89367824 02
XE	.13165922 09	YE	.69537857 08	ZE	-.24250000 02	DXE	-.14389682 02	DYE	.26241811 02	DZE	-.10247230-02
XT	.13138631 09	YT	.69826517 08	ZT	.49480000 04	DXT	-.15135195 02	DYT	.25603730 02	DZT	.85213184-01
LTE	-.93315721-05	LOE	.27841467 02	LTT	.19053821-02	LOT	.27988837 02	RST	.14878879 09	VST	.29742770 02
EPS	.10542043 03	ESP	.15065786 00	SEP	.74428753 02	EPM	.79601622 01	EMP	.17185247 03	MEP	.18728045 00
MPS	.10615711 03	MSP	.27453512-18	SMP	.73839414 02	SEM	.74449797 02	EMS	.10540282 03	ESM	.14720910 00
EPT	.79601622 01	ETP	.17185247 03	TEP	.18728045 00	TPS	.10615711 03	TSP	.27453512-18	STP	.73839414 02
SET	.74449797 02	STE	.10540282 03	EST	.14720910 00	RPM	.93809357 04	RPT	.93809357 04	SPN	.10452155 03
GCE	.10285433 03	GCT	.94616967 02	SIP	.95480275 02	CPT	.93510878 02	SIN	.82834040 02	D1	.56559989 01
REP	.40656008 06	VEP	.21310924 01	CPE	.10147095 03	CPS	.93285797 02	D2	.18818568 01	D3	.30900630 00

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.64800642 04	Y	.55105285 04	Z	.39553506 04	DX	-.13556907 01	DY	.39138084 00	DZ	.44742047 00
R	.93809357 04	DEC	.24937988 02	RA	.13962276 03	V	.14802909 01	PTH	.66259187 02	AZ	.10325518 03
R	.93809347 04	LAT	.91069233 01	LON	.18731027 03	VR	.14705933 01	PTR	.67133425 02	AZR	.83600229 02
LTS	.15335482 01	LNS	.26118768 03	LTE	-.99268432 00	LNE	.65709740 01				
ALT	.76429357 04	SHA	-.90102515 04	ALP	.17742414 03	DR	.13550229 01	DP	.36399645-02	ASD	.10676838 02
HGE	.25457956 03	SVL	.79098806 01	HNG	.25368337 03	SIA	-.27166758 01				

2 DAYS 16 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.25000000 OCT. 21,1962 18 00 00.000

CASE 1 SPACE TRAJECTORIES 19

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.28310789 06	Y	.26790734 06	Z	.12381256 06	DX	-.20406783 01	DY	-.27552663 00	DZ	.23855658 00
R	.40896695 06	DEC	.17622528 02	RA	.13658018 03	V	.20729670 01	PTH	.38993974 02	AZ	.95843736 02
R	.40896694 06	LAT	.17622528 02	LON	.19688237 03	VE	.26852266 02	PTE	.27843266 01	AZE	.26964956 03
XS	-.13163331 09	YS	-.63841423 08	ZS	-.27683161 08	DXS	.14399249 02	DYS	-.24071591 02	DZS	-.10436909 02
XM	-.27424242 06	YM	.26173583 06	ZM	.11908381 06	DXM	-.74234544 00	DYM	-.62278692 00	DZM	-.17612318 00
XT	-.27424242 06	YT	.26173583 06	ZT	.11908381 06	DXT	-.74234544 00	DYT	-.62278692 00	DZT	-.17612318 00
RS	.14889396 09	VS	.29928396 02	RM	.39736068 06	VM	.98486531 00	RT	.39736068 06	VT	.98486531 00
GED	.17735119 02	ALT	.40259072 06	LOS	.26617530 03	RAS	.20587312 03	RAM	.13633670 03	LOM	.19663688 03
DUT	.34000000 02	DT	.12000000 03	DR	.13043910 01	SHA	-.39321845 06	DES	-.10715087 02	DEM	.17438800 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13135020 09	Y	.69880141 08	Z	.69837499 04	DX	-.16439927 02	DY	.26078938 02	DZ	.32745516 00
R	.14878208 09	LAT	.26894326-02	LON	.28013599 02	V	.30830008 02	PTH	-.42130928 01	AZ	.89389585 02
XE	.13163331 09	YE	.69585089 08	ZE	-.26750000 02	DXE	-.14399249 02	DYE	.26236816 02	DZE	-.10238886-02
XT	.13135907 09	YT	.69872597 08	ZT	.51007500 04	DXT	-.15141594 02	DYT	.25595368 02	DZT	.85155129-01
LTE	-.10293648-04	LOE	.27862195 02	LTT	.19642352-02	LOT	.28009431 02	RST	.14878637 09	VST	.29738829 02
EPS	.10580062 03	ESP	.15114412 00	SEP	.74047945 02	EPM	.10028232 02	EMP	.16967569 03	MEP	.29615789 00
MPS	.11130176 03	MSP	.27453512-18	SMP	.68694007 02	SEM	.74216224 02	EMS	.10563652 03	ESM	.14720910 00
EPT	.10028232 02	ETP	.16967569 03	TEP	.29615789 00	TPS	.11130176 03	TSP	.27453512-18	STP	.68694007 02
SET	.74216224 02	STE	.10563652 03	EST	.14720910 00	RPM	.11791735 05	RPT	.11791735 05	SPN	.10490704 03
GCE	.10276921 03	GCT	.93919522 02	SIP	.10282598 03	CPT	.92448848 02	SIN	.83973063 02	D1	.44705676 01
REP	.40896695 06	VEP	.20729670 01	CPE	.10134361 03	CPS	.93290658 02	D2	.18623701 01	D3	.25982048 00

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.88654674 04	Y	.61715039 04	Z	.47287465 04	DX	-.12983329 01	DY	.34726030 00	DZ	.41467977 00
R	.11791735 05	DEC	.23642092 02	RA	.14515712 03	V	.14064911 01	PTH	.70301024 02	AZ	.10553859 03
R	.11791733 05	LAT	.96250930 01	LON	.19228771 03	VR	.13964068 01	PTR	.71491289 02	AZR	.84357027 02
LTS	.15337130 01	LNS	.26093378 03	LTE	-.10216674 01	LNE	.65502017 01				
ALT	.10053735 05	SHA	-.10985808 05	ALP	.17638034 03	DR	.13241785 01	DP	.23036306-02	ASD	.84757839 01
HGE	.25419937 03	SVL	.82407153 01	HNG	.24846496 03	SIA	.15524477 01				

2 DAYS 16 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.27083333 OCT. 21,1962 18 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.28673984 06	Y	.26738318 06	Z	.12422081 06	DX	-.19969622 01	DY	-.30485159 00	DZ	.21645206 00
R	.41127157 06	DEC	.17580220 02	RA	.13700064 03	V	.20316604 01	PTH	.38310407 02	AZ	.96193595 02
R	.41127156 06	LAT	.17580220 02	LON	.18978229 03	VE	.27034729 02	PTE	.26702112 01	AZE	.26963509 03
XS	-.13160738 09	YS	-.63884751 08	ZS	-.27701947 08	DXS	.14408813 02	DYS	-.24067005 02	DZS	-.10434922 02
XM	-.27557579 06	YM	.26061207 06	ZM	.11876554 06	DXM	-.73916505 00	DYM	-.62583827 00	DZM	-.17751238 00
XT	-.27557579 06	YT	.26061207 06	ZT	.11876554 06	DXT	-.73916505 00	DYT	-.62583827 00	DZT	-.17751238 00
RS	.14889312 09	VS	.29928619 02	RM	.39744926 06	VM	.98465686 00	RT	.39744926 06	VT	.98465686 00
GED	.17692576 02	ALT	.40489534 06	LOS	.25867447 03	RAS	.20589282 03	RAM	.13659857 03	LOM	.18938022 03
DUT	.34000000 02	DT	.24000000 03	DR	.12594701 01	SHA	-.39468668 06	DES	-.10722505 02	DEM	.17386705 02

CASE 1 SPACE TRAJECTORIES 20

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13132064 09	Y	.69927046 08	Z	.75657500 04	DX	-.16405776 02	DY	.26038242 02	DZ	.31884229 00
R	.14877803 09	LAT	.29136394-02	LON	.28034894 02	V	.30777283 02	PTH	-.41784297 01	AZ	.89404631 02
XE	.13160738 09	YE	.69632313 08	ZE	-.28000000 02	DXE	-.14408813 02	DYE	.26231819 02	DZE	-.10231733-02
XT	.13133180 09	YT	.69918665 08	ZT	.52545000 04	DXT	-.15147979 02	DYT	.25587018 02	DZT	.85095166-01
LTE	-.10774721-04	LOE	.27882924 02	LTT	.20234755-02	LOT	.28030024 02	RST	.14878394 09	VST	.29734895 02
EPS	.10617476 03	ESP	.15179003 00	SEP	.73673244 02	EPM	.12155719 02	EMP	.16741472 03	MEP	.42949881 00
MPS	.11470432 03	MSP	.27453512-18	SMP	.65290721 02	SEM	.73982760 02	EMS	.10587012 03	ESM	.14720910 00
EPT	.12155719 02	ETP	.16741472 03	TEP	.42949881 00	TPS	.11470432 03	TSP	.27453512-18	STP	.65290721 02
SET	.73982760 02	STE	.10587012 03	EST	.14720910 00	RPM	.14150758 05	RPT	.14150758 05	SPN	.10528618 03
GCE	.10268716 03	GCT	.93431173 02	SIP	.10764943 03	CPT	.91733834 02	SIN	.84678936 02	D1	.37127176 01
REP	.41127157 06	VEP	.20316604 01	CPE	.10121968 03	CPS	.93295518 02	D2	.17336505 01	D3	.21142538 00

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.11164048 05	Y	.67711189 04	Z	.54552658 04	DX	-.12577971 01	DY	.32098668 00	DZ	.39396445 00
R	.14150758 05	DEC	.22675436 02	RA	.14876273 03	V	.13565744 01	PTH	.73071295 02	AZ	.10696467 03
R	.14150756 05	LAT	.99247266 01	LON	.19550382 03	VR	.13462733 01	PTR	.74576771 02	AZR	.84841104 02
LTS	.15338786 01	LNS	.26067986 03	LTE	-.10506180 01	LNE	.65293261 01				
ALT	.12412758 05	SHA	-.12855121 05	ALP	.17562886 03	DR	.12977911 01	DP	.15993746-02	ASD	.70548981 01
HGE	.25382524 03	SVL	.84024038 01	HNG	.24500934 03	SIA	.51008213 01				

2 DAYS 17 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.29166666 OCT. 21,1962 19 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.29030315 06	Y	.26681520 06	Z	.12459560 06	DX	-.19636445 01	DY	-.32513217 00	DZ	.20078499 00
R	.41350977 06	DEC	.17536441 02	RA	.13741414 03	V	.20004812 01	PTH	.37914990 02	AZ	.96471444 02
R	.41350976 06	LAT	.17536441 02	LON	.18267526 03	VE	.27212424 02	PTE	.25891283 01	AZE	.26962509 03
XS	-.13158143 09	YS	-.63928068 08	ZS	-.27720728 08	DXS	.14418376 02	DYS	-.24062417 02	DZS	-.10432933 02
XM	-.27690342 06	YM	.25948282 06	ZM	.11844477 06	DXM	-.73597159 00	DYM	-.62887464 00	DZM	-.17889701 00
XT	-.27690342 06	YT	.25948282 06	ZT	.11844477 06	DXT	-.73597159 00	DYT	-.62887464 00	DZT	-.17889701 00
RS	.14889228 09	VS	.29928841 02	RM	.39753742 06	VM	.98444992 00	RT	.39753742 06	VT	.98444992 00
GED	.17648554 02	ALT	.40713352 06	LOS	.25117363 03	RAS	.20591252 03	RAM	.13686018 03	LOM	.18212129 03
DUT	.34000000 02	DT	.24000000 03	DR	.12292790 01	SHA	-.39607840 06	DES	-.10729924 02	DEM	.17334289 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13129113 09	Y	.69973888 08	Z	.81332500 04	DX	-.16382021 02	DY	.26008401 02	DZ	.31253695 00
R	.14877401 09	LAT	.31322734-02	LON	.28056158 02	V	.30739310 02	PTH	-.41493604 01	AZ	.89415687 02
XE	.13158143 09	YE	.69679528 08	ZE	-.30250000 02	DXE	-.14418376 02	DYE	.26226818 02	DZE	-.10228157-02
XT	.13130453 09	YT	.69964714 08	ZT	.54072499 04	DXT	-.15154348 02	DYT	.25578681 02	DZT	.85033177-01
LTE	-.11640612-04	LOE	.27903653 02	LTT	.20823325-02	LOT	.28050613 02	RST	.14878152 09	VST	.29730967 02
EPS	.10654290 03	ESP	.15243321 00	SEP	.73304555 02	EPM	.13793414 02	EMP	.16564073 03	MEP	.56583430 00
MPS	.11713407 03	MSP	.98911702-02	SMP	.62860287 02	SEM	.73749407 02	EMS	.10610362 03	ESM	.14754103 00
EPT	.13793414 02	ETP	.16564073 03	TEP	.56583430 00	TPS	.11713407 03	TSP	.98911702-02	STP	.62860287 02
SET	.73749407 02	STE	.10610362 03	EST	.14754103 00	RPM	.16466612 05	RPT	.16466612 05	SPN	.10565914 03
GCE	.10260739 03	GCT	.93065887 02	SIP	.11107539 03	CPT	.91218341 02	SIN	.85159663 02	D1	.31841931 01
REP	.41350977 06	VEP	.20004812 01	CPE	.10109843 03	CPS	.93300372 02	D2	.15941236 01	D3	.17324346 00

CASE 1 SPACE TRAJECTORIES 21

RA-5 POSTMIDCOURSE ORBIT

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.13399730 05	Y	.73323870 04	Z	.61508249 04	DX	-.12276729 01	DY	.30374248 00	DZ	.37968200 00
R	.16466612 05	DEC	.21933679 02	RA	.15131234 03	V	.13204540 01	PTH	.75107124 02	AZ	.10794289 03
R	.16466609 05	LAT	.10116789 02	LON	.19773268 03	VR	.13100568 01	PTR	.76925745 02	AZR	.85155731 02
LTS	.15340442 01	LNS	.26042594 03	LTE	-.10795379 01	LNE	.65083395 01				
ALT	.14728612 05	SHA	-.14653586 05	ALP	.17506127 03	DR	.12760974 01	DP	.11808532-02	ASD	.60586783 01
HGE	.25345709 03	SVL	.84831546 01	HNG	.24254065 03	SIA	.77347356 01				

2 DAYS 17 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.3125000 OCT. 21,1962 19 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.29381304 06	Y	.26621578 06	Z	.12494592 06	DX	-.19371653 01	DY	-.34023787 00	DZ	.18896244 00
R	.41570233 06	DEC	.17491591 02	RA	.13782115 03	V	.19758740 01	PTH	.37691583 02	AZ	.96706126 02
R	.41570231 06	LAT	.17491591 02	LON	.17556174 03	VE	.27386256 02	PTE	.25282679 01	AZE	.26961763 03
XS	-.13155547 09	YS	-.63971377 08	ZS	-.27739506 08	DXS	.14427937 02	DYS	-.24057824 02	DZS	-.10430942 02
XM	-.27822529 06	YM	.25834812 06	ZM	.11812152 06	DXM	-.73276517 00	DYM	-.63189603 00	DZM	-.18027706 00
XT	-.27822529 06	YT	.25834812 06	ZT	.11812152 06	DXT	-.73276517 00	DYT	-.63189603 00	DZT	-.18027706 00
RS	.14889143 09	VS	.29929063 02	RM	.39762514 06	VM	.98424447 00	RT	.39762514 06	VT	.98424447 00
GED	.17603454 02	ALT	.40932607 06	LOS	.24367281 03	RAS	.20593223 03	RAM	.13712153 03	LOM	.17486211 03
DUT	.34000000 02	DT	.24000000 03	DR	.12080708 01	SHA	-.39741390 06	DES	-.10737339 02	DEM	.17281555 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13126166 09	Y	.70020682 08	Z	.86917499 04	DX	-.16365103 02	DY	.25984833 02	DZ	.30770099 00
R	.14877002 09	LAT	.33474525-02	LON	.28077400 02	V	.30710304 02	PTH	-.41248511 01	AZ	.89424185 02
XE	.13155547 09	YE	.69726732 08	ZE	-.31500000 02	DXE	-.14427937 02	DYE	.26221812 02	DZE	-.10219812-02
XT	.13127725 09	YT	.70010749 08	ZT	.55607500 04	DXT	-.15160703 02	DYT	.25570354 02	DZT	.84969996-01
LTE	-.12121698-04	LOE	.27924380 02	LTT	.21414802-02	LOT	.28071199 02	RST	.14877909 09	VST	.29727044 02
EPS	.10690540 03	ESP	.15307370 00	SEP	.72941543 02	EPM	.15016216 02	EMP	.16428387 03	MEP	.69994006 00
MPS	.11896210 03	MSP	.27453512-18	SMP	.61031578 02	SEM	.73516162 02	EMS	.10633700 03	ESM	.14687642 00
EPT	.15016216 02	ETP	.16428387 03	TEP	.69994006 00	TPS	.11896210 03	TSP	.27453512-18	STP	.61031578 02
SET	.73516162 02	STE	.10633700 03	EST	.14687642 00	RPM	.18747014 05	RPT	.18747014 05	SPN	.10602629 03
GCE	.10252943 03	GCT	.92780507 02	SIP	.11364268 03	CPT	.90828197 02	SIN	.85508774 02	D1	.27932727 01
REP	.41570233 06	VEP	.19758740 01	CPE	.10097936 03	CPS	.93305226 02	D2	.14659330 01	D3	.14397686 00

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.15587754 05	Y	.78676527 04	Z	.68244023 04	DX	-.12044002 01	DY	.29165815 00	DZ	.36923950 00
R	.18747014 05	DEC	.21347659 02	RA	.15321841 03	V	.12930514 01	PTH	.76676505 02	AZ	.10865941 03
R	.18747011 05	LAT	.10248860 02	LON	.19934937 03	VR	.12826505 01	PTR	.78805853 02	AZR	.85353838 02
LTS	.15342073 01	LNS	.26017202 03	LTE	-.11084227 01	LNE	.64872615 01				
ALT	.17009014 05	SHA	-.16401514 05	ALP	.17461658 03	DR	.12582483 01	DP	.91071077-03	ASD	.53194221 01
HGE	.25309459 03	SVL	.85199958 01	HNG	.24068344 03	SIA	.96967539 01				

2 DAYS 18 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.33333333 OCT. 21,1962 20 00 00.000

CASE 1 SPACE TRAJECTORIES 22

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.29727978 06	Y	.26559227 06	Z	.12527734 06	DX	-.19154212 01	DY	-.35211445 00	DZ	.17962242 00
R	.41786233 06	DEC	.17445908 02	RA	.13822212 03	V	.19557829 01	PTH	.37578745 02	AZ	.96912535 02
R	.41786232 06	LAT	.17445909 02	LON	.16844218 03	VE	.27557080 02	PTE	.24806735 01	AZE	.26961176 03
XS	-.13152949 09	YS	-.64014678 08	ZS	-.27758281 08	DXS	.14437498 02	DYS	-.24053228 02	DZS	-.10428950 02
XM	-.27954137 06	YM	.25720800 06	ZM	.11779578 06	DXM	-.72954582 00	DYM	-.63490237 00	DZM	-.18165249 00
XT	-.27954137 06	YT	.25720800 06	ZT	.11779578 06	DXT	-.72954582 00	DYT	-.63490237 00	DZT	-.18165249 00
RS	.14889059 09	VS	.29929285 02	RM	.39771243 06	VM	.98404051 00	RT	.39771243 06	VT	.98404051 00
GED	.17557517 02	ALT	.41148606 06	LOS	.23617198 03	RAS	.20595193 03	RAM	.13738262 03	LOM	.16760266 03
DUT	.34000000 02	DT	.24000000 03	DR	.11927366 01	SHA	-.39870588 06	DES	-.10744755 02	DEM	.17228506 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13123221 09	Y	.70067437 08	Z	.92417499 04	DX	-.16352919 02	DY	.25965212 02	DZ	.30385721 00
R	.14876605 09	LAT	.35593688-02	LON	.28098626 02	V	.30687172 02	PTH	-.41039020 01	AZ	.89430948 02
XE	.13152949 09	YE	.69773928 08	ZE	-.34000000 02	DXE	-.14437498 02	DYE	.26216803 02	DZE	-.10211468-02
XT	.13124995 09	YT	.70056769 08	ZT	.57130000 04	DXT	-.15167044 02	DYT	.25562039 02	DZT	.84904788-01
LTE	-.13083812-04	LOE	.27945110 02	LTT	.22001484-02	LOT	.28091785 02	RST	.14877668 09	VST	.29723127 02
EPS	.10726257 03	ESP	.15355230 00	SEP	.72583865 02	EPM	.15930725 02	EMP	.16323894 03	MEP	.83030605 00
MPS	.12039028 03	MSP	.27453512-18	SMP	.59602743 02	SEM	.73283026 02	EMS	.10657028 03	ESM	.14604142 00
EPT	.15930725 02	ETP	.16323894 03	TEP	.83030605 00	TPS	.12039028 03	TSP	.27453512-18	STP	.59602743 02
SET	.73283026 02	STE	.10657028 03	EST	.14604142 00	RPM	.20998113 05	RPT	.20998113 05	SPN	.10638801 03
GCE	.10245295 03	GCT	.92550565 02	SIP	.11564251 03	CPT	.90522128 02	SIN	.85774361 02	D1	.24916297 01
REP	.41786233 06	VEP	.19557829 01	CPE	.10086214 03	CPS	.93310079 02	D2	.13530139 01	D3	.12139802 00

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.17738405 05	Y	.83842685 04	Z	.74815633 04	DX	-.11858753 01	DY	.28278792 00	DZ	.36127491 00
R	.20998113 05	DEC	.20872950 02	RA	.15470168 03	V	.12715301 01	PTH	.77929262 02	AZ	.10921063 03
R	.20998110 05	LAT	.10344391 02	LON	.20055847 03	VR	.12612002 01	PTR	.80366889 02	AZR	.85463539 02
LTS	.15343721 01	LNS	.25991810 03	LTE	-.11372743 01	LNE	.64660785 01				
ALT	.19260113 05	SHA	-.18111668 05	ALP	.17425830 03	DR	.12434168 01	DP	.72554192-03	ASD	.47477660 01
HGE	.25273742 03	SVL	.85308217 01	HNG	.23923306 03	SIA	.11182959 02				

2 DAYS 18 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.35416666 OCT. 21,1962 20 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.30071060 06	Y	.26494944 06	Z	.12559357 06	DX	-.18970948 01	DY	-.36184120 00	DZ	.17198157 00
R	.41999859 06	DEC	.17399550 02	RA	.13861743 03	V	.19389367 01	PTH	.37540929 02	AZ	.97099167 02
R	.41999858 06	LAT	.17399550 02	LON	.16 31695 03	VE	.27725582 02	PTE	.24422383 01	AZE	.26960698 03
XS	-.13150349 09	YS	-.64057973 08	ZS	-.27777052 08	DXS	.14447056 02	DYS	-.24048629 02	DZS	-.10426957 02
XM	-.28085165 06	YM	.25606247 06	ZM	.11746757 06	DXM	-.72631362 00	DYM	-.63789364 00	DZM	-.18302331 00
XT	-.28085165 06	YT	.25606247 06	ZT	.11746757 06	DXT	-.72631362 00	DYT	-.63789364 00	DZT	-.18302331 00
RS	.14888974 09	VS	.29929507 02	RM	.39779928 06	VM	.98383804 00	RT	.39779928 06	VT	.98383804 00
GED	.17510899 02	ALT	.41362231 06	LOS	.22867114 03	RAS	.20597163 03	RAM	.13764345 03	LOM	.16034296 03
DUT	.34000000 02	DT	.48000000 03	DR	.11814485 01	SHA	-.39996289 06	DES	-.10752169 02	DEM	.17175141 02

CASE 1 SPACE TRAJECTORIES 23

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13120278 09	Y	.70114163 08	Z	.97854999 04	DX	-.16344151 02	DY	.25948236 02	DZ	.30071747 00
R	.14876211 09	LAT	.37688886-02	LON	.28119840 02	V	.30668104 02	PTH	-.40857337 01	AZ	.89436474 02
XE	.13150349 09	YE	.69821116 08	ZE	-.36250000 02	DXE	-.14447056 02	DYE	.26211790 02	DZE	-.10205507-02
XT	.13122264 09	YT	.70102776 08	ZT	.58655000 04	DXT	-.15173369 02	DYT	.25553737 02	DZT	.84837794-01
LTE	-.13949731-04	LOE	.27965840 02	LTT	.22589148-02	LOT	.28112367 02	RST	.14877426 09	VST	.29719216 02
EPS	.10761474 03	ESP	.15387055 00	SEP	.72231215 02	EPM	.16617470 02	EMP	.16242585 03	MEP	.95664632 00
MPS	.12153825 03	MSP	.27453512-18	SMP	.58454123 02	SEM	.73049997 02	EMS	.10680345 03	ESM	.14604142 00
EPT	.16617470 02	ETP	.16242585 03	TEP	.95664632 00	TPS	.12153825 03	TSP	.27453512-18	STP	.58454123 02
SET	.73049997 02	STE	.10680345 03	EST	.14604142 00	RPM	.23224731 05	RPT	.23224731 05	SPN	.10674462 03
GCE	.10237773 03	GCT	.92360972 02	SIP	.11724656 03	CPT	.90275333 02	SIN	.85983646 02	D1	.22513334 01
REP	.41999859 06	VEP	.19389367 01	CPE	.10074655 03	CPS	.93314929 02	D2	.12545623 01	D3	.10371890 00

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.19858956 05	Y	.88869613 04	Z	.81260030 04	DX	-.11707812 01	DY	.27605244 00	DZ	.35500488 00
R	.23224731 05	DEC	.20480328 02	RA	.15589129 03	V	.12541778 01	PTH	.78956265 02	AZ	.10965140 03
R	.23224727 05	LAT	.10416152 02	LON	.20148155 03	VR	.12439823 01	PTR	.81699771 02	AZR	.85499025 02
LTS	.15345369 01	LNS	.25966416 03	LTE	-.11660926 01	LNE	.64447875 01				
ALT	.21486731 05	SHA	-.19792615 05	ALP	.17396325 03	DR	.12309521 01	DP	.59269560-03	ASD	.42916861 01
HGE	.25238525 03	SVL	.85251952 01	HNG	.23806804 03	SIA	.12325784 02				

2 DAYS 19 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.3750000 OCT. 21,1962 21 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.30411085 06	Y	.26429053 06	Z	.12589720 06	DX	-.18813203 01	DY	-.37006277 00	DZ	.16555731 00
R	.42211727 06	DEC	.17352626 02	RA	.13900740 03	V	.19245056 01	PTH	.37556143 02	AZ	.97271243 02
R	.42211727 06	LAT	.17352626 02	LON	.15418638 03	VE	.27892288 02	PTE	.24103874 01	AZE	.26960298 03
XS	-.13147748 09	YS	-.64101256 08	ZS	-.27795820 08	DXS	.14456613 02	DYS	-.24044026 02	DZS	-.10424962 02
XM	-.28215610 06	YM	.25491158 06	ZM	.11713689 06	DXM	-.72306868 00	DYM	-.64086980 00	DZM	-.18438948 00
XT	-.28215610 06	YT	.25491158 06	ZT	.11713689 06	DXT	-.72306868 00	DYT	-.64086980 00	DZT	-.18438948 00
RS	.14888890 09	VS	.29929729 02	RM	.39788570 06	VM	.98363706 00	RT	.39788570 06	VT	.98363706 00
GED	.17463713 02	ALT	.41574099 06	LOS	.22117032 03	RAS	.20599134 03	RAM	.13790402 03	LOM	.15308300 03
CUT	.34000000 02	DT	.48000000 03	DR	.11730603 01	SHA	-.40119093 06	DES	-.10759582 02	DEM	.17121462 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13117337 09	Y	.70160855 08	Z	.10325000 05	DX	-.16337933 02	DY	.25933121 02	DZ	.29809535 00
R	.14875819 09	LAT	.39767822-02	LON	.28141041 02	V	.30651977 02	PTH	-.40697588 01	AZ	.89441089 02
XE	.13147748 09	YE	.69868294 08	ZE	.37000000 02	DXE	-.14456613 02	DYE	.26206774 02	DZE	-.10195970-02
XT	.13119532 09	YT	.70148766 08	ZT	.60190000 04	DXT	-.15179682 02	DYT	.25545447 02	DZT	.84769486-01
LTE	-.14238427-04	LOE	.27986569 02	LTT	.23180683-02	LOT	.28132948 02	RST	.14877184 09	VST	.29715312 02
EPS	.10796215 03	ESP	.15466329 00	SEP	.71883325 02	EPM	.17133191 02	EMP	.16178793 03	MEP	.10788792 01
MPS	.12248168 03	MSP	.27453512-18	SMP	.57510052 02	SEM	.72817075 02	EMS	.10703653 03	ESM	.14637599 00
EPT	.17133191 02	ETP	.16178793 03	TEP	.10788792 01	TPS	.12248168 03	TSP	.27453512-18	STP	.57510052 02
SET	.72817075 02	STE	.10703653 03	EST	.14637599 00	RPM	.25430664 05	RPT	.25430664 05	SPN	.10709640 03
GCE	.10230359 03	GCT	.92201836 02	SIP	.11856288 03	CPT	.90071989 02	SIN	.86153185 02	D1	.20550857 01
REP	.42211727 06	VEP	.19245056 01	CPE	.10063240 03	CPS	.93319780 02	D2	.11686815 01	D3	.89651548-01

CASE 1 SPACE TRAJECTORIES 24

RA-5 POSTMIDCOURSE ORBIT

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.21954751 05	Y	.93789469 04	Z	.87603047 04	DX	-.11582516 01	DY	.27080702 00	DZ	.34994679 00
R	.25430664 05	DEC	.20149934 02	RA	.15686809 03	V	.12398576 01	PTH	.79816085 02	AZ	.11001530 03
R	.25430660 05	LAT	.10471646 02	LON	.20219561 03	VR	.12298518 01	PTR	.82863227 02	AZR	.85465207 02
LTS	.15347008 01	LNS	.25941024 03	LTE	-.11948758 01	LNE	.64234099 01				
ALT	.23692664 05	SHA	-.21450401 05	ALP	.17371600 03	DR	.12203634 01	DP	.49391629-03	ASD	.39188030 01
HGE	.25203784 03	SVL	.85086346 01	HNG	.23711145 03	SIA	.13214388 02				

2 DAYS 19 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.39583333 OCT. 21,1962 21 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.30748454 06	Y	.26361786 06	Z	.12619011 06	DX	-.18675045 01	DY	-.37718708 00	DZ	.16003599 00
R	.42422289 06	DEC	.17305216 02	RA	.13939229 03	V	.19119243 01	PTH	.37610044 02	AZ	.97432157 02
R	.42422288 06	LAT	.17305216 02	LON	.14705074 03	VE	.28057603 02	PTE	.23834150 01	AZE	.26959957 03
XS	-.13145145 09	YS	-.64144532 08	ZS	-.27814583 08	DXS	.14466168 02	DYS	-.24039420 02	DZS	-.10422966 02
XM	-.28345470 06	YM	.25375535 06	ZM	.11680377 06	DXM	-.71981105 00	DYM	-.64383083 00	DZM	-.18575099 00
XT	-.28345470 06	YT	.25375535 06	ZT	.11680377 06	DXT	-.71981105 00	DYT	-.64383083 00	DZT	-.18575099 00
RS	.14888806 09	VS	.29929950 02	RM	.39797168 06	VM	.98343759 00	RT	.39797168 06	VT	.98343759 00
GED	.17416038 02	ALT	.41784659 06	LOS	.21366949 03	RAS	.20601104 03	RAM	.13816434 03	LOM	.14582279 03
DUT	.34000000 02	DT	.48000000 03	DR	.11668170 01	SHA	-.40239440 06	DES	-.10766993 02	DEM	.17067472 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13114396 09	Y	.70207524 08	Z	.10859250 05	DX	-.16333672 02	DY	.25919368 02	DZ	.29586470 00
R	.14875428 09	LAT	.41826640-02	LON	.28162233 02	V	.30638048 02	PTH	-.40555366 01	AZ	.89445014 02
XE	.13145145 09	YE	.69915463 08	ZE	-.39500000 02	DXE	-.14466168 02	DYE	.26201754 02	DZE	-.10187626-02
XT	.13116799 09	YT	.70194742 08	ZT	.61712500 04	DXT	-.15185979 02	DYT	.25537169 02	DZT	.84699153-01
LTE	-.15200568-04	LOE	.28007299 02	LTT	.23767420-02	LOT	.28153525 02	RST	.14876943 09	VST	.29711413 02
EPS	.10830504 03	ESP	.15482135 00	SEP	.71539971 02	EPM	.17517952 02	EMP	.16128508 03	MEP	.11969351 01
MPS	.12327089 03	MSP	.27453512-18	SMP	.56720208 02	SEM	.72584262 02	EMS	.10726949 03	ESM	.14604142 00
EPT	.17517952 02	ETP	.16128508 03	TEP	.11969351 01	TPS	.12327089 03	TSP	.27453512-18	STP	.56720208 02
SET	.72584262 02	STE	.10726949 03	EST	.14604142 00	RPM	.27618941 05	RPT	.27618941 05	SPN	.10744359 03
GCE	.10223043 03	GCT	.92066357 02	SIP	.11966301 03	CPT	.89901505 02	SIN	.86293621 02	D1	.18915838 01
REP	.42422289 06	VEP	.19119243 01	CPE	.10051957 03	CPS	.93324628 02	D2	.10934307 01	D3	.78285311-01

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.24029841 05	Y	.98625126 04	Z	.93863478 04	DX	-.11476935 01	DY	.26664375 00	DZ	.34578698 00
R	.27618941 05	DEC	.19867846 02	RA	.15768539 03	V	.12279527 01	PTH	.80548348 02	AZ	.11032405 03
R	.27618936 05	LAT	.10515546 02	LON	.20275193 03	VR	.12181867 01	PTR	.83896948 02	AZR	.85359140 02
LTS	.15348639 01	LNS	.25915632 03	LTE	-.12236250 01	LNE	.64019332 01				
ALT	.25880941 05	SHA	-.23089460 05	ALP	.17350586 03	DR	.12112826 01	DP	.41832172-03	ASD	.36078826 01
HGE	.25169495 03	SVL	.84845147 01	HNG	.23631210 03	SIA	.13910070 02				

2 DAYS 20 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.41666666 OCT. 21,1962 22 00 00.000

CASE 1 SPACE TRAJECTORIES 25

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.31083480 06	Y	.26293314 06	Z	.12647374 06	DX	-.18552273 01	DY	-.38348445 00	DZ	.15520476 00
R	.42631879 06	DEC	.17257385 02	RA	.13977233 03	V	.19007938 01	PTH	.37692886 02	AZ	.97584222 02
R	.42631878 06	LAT	.17257386 02	LON	.13991025 03	VE	.28221842 02	PTE	.23601565 01	AZE	.26959663 03
XS	-.13142540 09	YS	-.64187800 08	ZS	-.27833344 08	DXS	.14475722 02	DYS	-.24034811 02	DZS	-.10420968 02
XM	-.28474742 06	YM	.25259380 06	ZM	.11646819 06	DXM	-.71654080 00	DYM	-.64677668 00	DZM	-.18710782 00
XT	-.28474742 06	YT	.25259380 06	ZT	.11646819 06	DXT	-.71654080 00	DYT	-.64677668 00	DZT	-.18710782 00
RS	.14888722 09	VS	.29930172 02	RM	.39805723 06	VM	.98323960 00	RT	.39805723 06	VT	.98323960 00
GED	.17367940 02	ALT	.41994248 06	LOS	.20616866 03	RAS	.20603075 03	RAM	.13842440 03	LOM	.13856231 03
DLT	.34000000 02	DT	.48000000 03	DR	.11622001 01	SHA	-.40357666 06	DES	-.10774404 02	DEM	.17013173 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13111456 09	Y	.70254168 08	Z	.11390500 05	DX	-.16330949 02	DY	.25906645 02	DZ	.29393864 00
R	.14875039 09	LAT	.43874007-02	LON	.28183417 02	V	.30625815 02	PTH	-.40427334 01	AZ	.89448399 02
XE	.13142540 09	YE	.69962623 08	ZE	-.40500000 02	DXE	-.14475722 02	DYE	.26196731 02	DZE	-.10176897-02
XT	.13114065 09	YT	.70240702 08	ZT	.63242500 04	DXT	-.15192262 02	DYT	.25528903 02	DZT	.84627270-01
LTE	-.15585481-04	LOE	.28028030 02	LTT	.24357066-02	LOT	.28174100 02	RST	.14876702 09	VST	.29707522 02
EPS	.10864359 03	ESP	.15513699 00	SEP	.71200958 02	EPM	.17800539 02	EMP	.16088841 03	MEP	.13110285 01
MPS	.12394073 03	MSP	.98911702-02	SMP	.56049748 02	SEM	.72351552 02	EMS	.10750235 03	ESM	.14587384 00
EPT	.17800539 02	ETP	.16088841 03	TEP	.13110285 01	TPS	.12394073 03	TSP	.98911702-02	STP	.56049748 02
SET	.72351552 02	STE	.10750235 03	EST	.14587384 00	RPM	.29792017 05	RPT	.29792017 05	SPN	.10778638 03
GCE	.10215813 03	GCT	.91949689 02	SIP	.12059632 03	CPT	.89756528 02	SIN	.86412121 02	D1	.17531190 01
REP	.42631879 06	VEP	.19007938 01	CPE	.10040796 03	CPS	.93329475 02	D2	.10271062 01	D3	.68972392-01

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.26087376 05	Y	.10339349 05	Z	.10005547 05	DX	-.11386865 01	DY	.26329223 00	DZ	.34231257 00
R	.29792017 05	DEC	.19624025 02	RA	.15837982 03	V	.12178290 01	PTH	.81180874 02	AZ	.11059241 03
R	.29792011 05	LAT	.10550906 02	LON	.20318602 03	VR	.12083488 01	PTR	.84828874 02	AZR	.85169094 02
LTS	.15350278 01	LNS	.25890237 03	LTE	-.12523374 01	LNE	.63803439 01				
ALT	.28054017 05	SHA	-.24713157 05	ALP	.17332515 03	DR	.12034310 01	DP	.35908336-03	ASD	.33444063 01
HGE	.25135640 03	SVL	.84550031 01	HNG	.23563451 03	SIA	.14456133 02				

2 DAYS 20 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.43750000 OCT. 21,1962 22 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.31416410 06	Y	.26223769 06	Z	.12674917 06	DX	-.18441826 01	DY	-.38914105 00	DZ	.15091396 00
R	.42840756 06	DEC	.17209184 02	RA	.14014772 03	V	.18908240 01	PTH	.37797804 02	AZ	.97729067 02
R	.42840755 06	LAT	.17209185 02	LON	.13276510 03	VE	.28385248 02	PTE	.23397786 01	AZE	.26959406 03
XS	-.13139933 09	YS	-.64231062 08	ZS	-.27852101 08	DXS	.14485274 02	DYS	-.24030198 02	DZS	-.10418969 02
XM	-.28603425 06	YM	.25142695 06	ZM	.11613018 06	DXM	-.71325801 00	DYM	-.64970733 00	DZM	-.18845995 00
XT	-.28603425 06	YT	.25142695 06	ZT	.11613018 06	DXT	-.71325801 00	DYT	-.64970733 00	DZT	-.18845995 00
RS	.14888638 09	VS	.29930393 02	RM	.39814233 06	VM	.98304310 00	RT	.39814233 06	VT	.98304310 00
GED	.17319469 02	ALT	.42203124 06	LOS	.19866784 03	RAS	.20605046 03	RAM	.13868420 03	LOM	.13130158 03
DLT	.34000000 02	DT	.48000000 03	DR	.11588422 01	SHA	-.40474029 06	DES	-.10781814 02	DEM	.16958564 02

CASE 1 SPACE TRAJECTORIES 26

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13108517 09	Y	.70300792 08	Z	.11917500 05	DX	-.16329456 02	DY	.25894720 02	DZ	.29225314 00
R	.14874651 09	LAT	.45905107-02	LON	.28204595 02	V	.30614916 02	PTH	-.40310948 01	AZ	.89451361 02
XE	.13139933 09	YE	.70009776 08	ZE	-.42750000 02	DXE	-.14485274 02	DYE	.26191703 02	DZE	-.10170936-02
XT	.13111330 09	YT	.70286650 08	ZT	.64760000 04	DXT	-.15198532 02	DYT	.25520648 02	DZT	.84553359-01
LTE	-.16451434-04	LOE	.28048760 02	LTT	.24941917-02	LOT	.28194674 02	RST	.14876461 09	VST	.29703636 02
EPS	.10897797 03	ESP	.15560925 00	SEP	.70866121 02	EPM	.18002073 02	EMP	.16057672 03	MEP	.14211501 01
MPS	.12451612 03	MSP	.27453512-18	SMP	.55473740 02	SEM	.72118948 02	EMS	.10773511 03	ESM	.14604142 00
EPT	.18002073 02	ETP	.16057672 03	TEP	.14211501 01	TPS	.12451612 03	TSP	.27453512-18	STP	.55473740 02
SET	.72118948 02	STE	.10773511 03	EST	.14604142 00	RPM	.31951901 05	RPT	.31951901 05	SPN	.10812494 03
GCE	.10208663 03	GCT	.91848265 02	SIP	.12139802 03	CPT	.89631772 02	SIN	.86513673 02	D1	.16342472 01
REP	.42840756 06	VEP	.18908240 01	CPE	.10029748 03	CPS	.93334322 02	D2	.96828608 00	D3	.61245602-01

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.28129858 05	Y	.10810738 05	Z	.10618994 05	DX	-.11309247 01	DY	.26056628 00	DZ	.33937391 00
R	.31951901 05	DEC	.19411052 02	RA	.15897746 03	V	.12091567 01	PTH	.81733823 02	AZ	.11083074 03
R	.31951898 05	LAT	.10579796 02	LON	.20352337 03	VR	.12000050 01	PTR	.85679205 02	AZR	.84870688 02
LTS	.15351917 01	LNS	.25864843 03	LTE	-.12810139 01	LNE	.63586678 01				
ALT	.30213901 05	SHA	-.26324101 05	ALP	.17316825 03	DR	.11965946 01	DP	.31173297-03	ASC	.31180991 01
HGE	.25102202 03	SVL	.84215403 01	HNG	.23505327 03	SIA	.14883974 02				

2 DAYS 21 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.45833333 OCT. 21,1962 23 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.31747446 06	Y	.26153253 06	Z	.12701729 06	DX	-.18341421 01	DY	-.39428905 00	DZ	.14705531 00
R	.43049122 06	DEC	.17160654 02	RA	.14051861 03	V	.18817987 01	PTH	.37919839 02	AZ	.97867883 02
R	.43049121 06	LAT	.17160654 02	LON	.12561546 03	VE	.28548019 02	PTE	.23216760 01	AZE	.26959181 03
XS	-.13137325 09	YS	-.64274313 08	ZS	-.27870854 08	DXS	.14494824 02	DYS	-.24025582 02	DZS	-.10416968 02
XM	-.28731515 06	YM	.25025485 06	ZM	.11578974 06	DXM	-.70996276 00	DYM	-.65262274 00	DZM	-.18980737 00
XT	-.28731515 06	YT	.25025485 06	ZT	.11578974 06	DXT	-.70996276 00	DYT	-.65262274 00	DZT	-.18980737 00
RS	.14888554 09	VS	.29930615 02	RM	.39822700 06	VM	.98284810 00	RT	.39822700 06	VT	.98284810 00
GED	.17270665 02	ALT	.42411489 06	LOS	.19116702 03	RAS	.20607017 03	RAM	.13894375 03	LOM	.12404060 03
DUT	.34000000 02	DT	.95999999 03	DR	.11564752 01	SHA	-.40588737 06	DES	-.10789221 02	DEM	.16903649 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13105578 09	Y	.70347394 08	Z	.12442000 05	DX	-.16328966 02	DY	.25883431 02	DZ	.29076147 00
R	.14874264 09	LAT	.47926679-02	LON	.28225765 02	V	.30605092 02	PTH	-.40204217 01	AZ	.89453977 02
XE	.13137325 09	YE	.70056918 08	ZE	-.45000000 02	DXE	-.14494824 02	DYE	.26186671 02	DZE	-.10163784-02
XT	.13108594 09	YT	.70332582 08	ZT	.66277499 04	DXT	-.15204787 02	DYT	.25512406 02	DZT	.84477662-01
LTE	-.17317397-04	LOE	.28069491 02	LTT	.25526785-02	LOT	.28215244 02	RST	.14876221 09	VST	.29699756 02
EPS	.10930834 03	ESP	.15639318 00	SEP	.70535313 02	EPM	.18138370 02	EMP	.16033407 03	MEP	.15275667 01
MPS	.12501540 03	MSP	.27453512-18	SMP	.54973844 02	SEM	.71886449 02	EMS	.10796777 03	ESM	.14587384 00
EPT	.18138370 02	ETP	.16033407 03	TEP	.15275667 01	TPS	.12501540 03	TSP	.27453512-18	STP	.54973844 02
SET	.71886449 02	STE	.10796777 03	EST	.14587384 00	RPM	.34100266 05	RPT	.34100266 05	SPN	.10845943 03
GCE	.10201585 03	GCT	.91759403 02	SIP	.12209392 03	CPT	.89523347 02	SIN	.86601868 02	D1	.15310101 01
REP	.43049122 06	VEP	.18817987 01	CPE	.10018807 03	CPS	.93339169 02	D2	.91580432 00	D3	.54762536-01

CASE 1 SPACE TRAJECTORIES 27

RA-5 POSTMIDCOURSE ORBIT

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.30159313 05	Y	.11277682 05	Z	.11227549 05	DX	-.11241793 01	DY	.25833370 00	DZ	.33686268 00
R	.34100266 05	DEC	.19223324 02	RA	.15949737 03	V	.12016622 01	PTH	.82222180 02	AZ	.11104660 03
R	.34100261 05	LAT	.10603671 02	LON	.20378271 03	VR	.11928793 01	PTR	.86462960 02	AZR	.84417527 02
LTS	.15353548 01	LNS	.25839450 03	LTE	-.13096546 01	LNE	.63369048 01				
ALT	.32362266 05	SHA	-.27924371 05	ALP	.17303089 03	DR	.11906072 01	DP	.27324191-03	ASD	.29214785 01
HGE	.25069165 03	SVL	.83851235 01	HNG	.23454969 03	SIA	.15216891 02				

2 DAYS 21 HRS. 33 MIN. 52.000 SEC. JULIAN DATE 2437959.47916666 OCT. 21,1962 23 30 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.32076752 06	Y	.26081849 06	Z	.12727878 06	DX	-.18249315 01	DY	-.39902500 00	DZ	.14354839 00
R	.43257135 06	DEC	.17111829 02	RA	.14088517 03	V	.18735533 01	PTH	.38055305 02	AZ	.98001562 02
R	.43257134 06	LAT	.17111829 02	LON	.11846149 03	VE	.28710306 02	PTE	.23053971 01	AZE	.26958984 03
XS	-.13134715 09	YS	-.64317556 08	ZS	-.27889603 08	DXS	.14504373 02	DYS	-.24020962 02	DZS	-.10414966 02
XM	-.28859011 06	YM	.24907751 06	ZM	.11544687 06	DXM	-.70665511 00	DYM	-.65552288 00	DZM	-.19115006 00
XT	-.28859011 06	YT	.24907751 06	ZT	.11544687 06	DXT	-.70665511 00	DYT	-.65552288 00	DZT	-.19115006 00
RS	.14888469 09	VS	.29930836 02	RM	.39831123 06	VM	.98265458 00	RT	.39831123 06	VT	.98265458 00
GED	.17221566 02	ALT	.42619501 06	LOS	.18366619 03	RAS	.20608988 03	RAM	.13920304 03	LOM	.11677936 03
DLT	.34000000 02	DT	.95999999 03	DR	.11548992 01	SHA	-.40701954 06	DES	-.10796628 02	DEM	.16848428 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13102638 09	Y	.70393975 08	Z	.12964500 05	DX	-.16329305 02	DY	.25872656 02	DZ	.28942943 00
R	.14873878 09	LAT	.49940648-02	LON	.28246930 02	V	.30596148 02	PTH	-.40105607 01	AZ	.89456312 02
XE	.13134715 09	YE	.70104050 08	ZE	-.46500000 02	DXE	-.14504373 02	DYE	.26181637 02	DZE	-.10153055-02
XT	.13105856 09	YT	.70378497 08	ZT	.67800000 04	DXT	-.15211028 02	DYT	.25504176 02	DZT	.84400653-01
LTE	-.17894745-04	LCE	.28090222 02	LTT	.26113598-02	LOT	.28235813 02	RST	.14875980 09	VST	.29695883 02
EPS	.10963481 03	ESP	.15670566 00	SEP	.70208402 02	EPM	.18221490 02	EMP	.16014829 03	MEP	.16302087 01
MPS	.12545238 03	MSP	.27453512-18	SMP	.54536249 02	SEM	.71654055 02	EMS	.10820033 03	ESM	.14553811 00
EPT	.18221490 02	ETP	.16014829 03	TEP	.16302087 01	TPS	.12545238 03	TSP	.27453512-18	STP	.54536249 02
SET	.71654055 02	STE	.10820033 03	EST	.14553811 00	RPM	.36238519 05	RPT	.36238519 05	SPN	.10878998 03
GCE	.10194576 03	GCT	.91681033 02	SIP	.12270342 03	CPT	.89428312 02	SIN	.86679351 02	D1	.14404581 01
REP	.43257135 06	VEP	.18735533 01	CPE	.10007968 03	CPS	.93344014 02	D2	.86870850 00	D3	.49268199-01

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.32177410 05	Y	.11740977 05	Z	.11831907 05	DX	-.11182764 01	DY	.25649788 00	DZ	.33469845 00
R	.36238519 05	DEC	.19056527 02	RA	.15995385 03	V	.11951386 01	PTH	.82657356 02	AZ	.11124566 03
R	.36238513 05	LAT	.10623580 02	LON	.20397816 03	VR	.11867632 01	PTR	.87191453 02	AZR	.83718501 02
LTS	.15355179 01	LNS	.25814056 03	LTE	-.13382586 01	LNE	.63150323 01				
ALT	.34500519 05	SHA	-.29515649 05	ALP	.17290979 03	DR	.11853380 01	DP	.24149618-03	ASD	.27489598 01
HGE	.25036518 03	SVL	.83464569 01	HNG	.23410969 03	SIA	.15472530 02				

2 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437959.50000000 OCT. 22,1962 00 00 00.000

CASE 1 SPACE TRAJECTORIES 28

RA-5 PCSTMIDCOURSE ORBIT

GEOCENTRIC EQUATORIAL COORDINATES

X	-.32404464 06	Y	.26009623 06	Z	.12753423 06	DX	-.18164155 C1	DY	-.40342137 00	DZ	.14033211 00
R	.43464924 06	CEC	.17062741 02	RA	.14124753 03	V	.18659601 C1	PTH	.38201407 02	AZ	.98130782 02
R	.43464923 06	LAT	.17062741 02	LON	.11130327 03	VE	.28872235 C2	PTE	.22905987 01	AZE	.26958811 03
XS	-.13132103 C9	YS	-.64360791 08	ZS	-.27908349 08	DXS	.14513920 02	DYS	-.24016339 02	DZS	-.10412962 C2
XM	-.28985911 06	YM	.24789497 06	ZM	.11510160 06	DXM	-.70333501 CC	DYM	-.65840796 00	DZM	-.19248808 C0
XT	-.28985911 06	YT	.24789497 06	ZT	.11510160 06	DXT	-.70333501 00	DYT	-.65840796 00	DZT	-.19248808 00
RS	.14888385 09	VS	.29931058 02	RM	.39839502 06	VM	.98246264 00	RT	.398395C2 06	VT	.98246264 00
GED	.17172202 02	ALT	.42827289 06	LOS	.17616533 03	RAS	.20610959 03	RAM	.13946208 C3	LOM	.10951781 03
DUT	.34000000 02	DT	.95999999 03	DR	.11539615 01	SHA	-.40813820 C6	DES	-.10804035 02	DEM	.16792903 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13099699 C9	Y	.70440538 08	Z	.13484250 05	DX	-.16330336 C2	DY	.25862305 02	DZ	.28822863 00
R	.14873493 09	LAT	.51944124-02	LON	.28268091 C2	V	.30587534 C2	PTH	-.40013835 C1	AZ	.89458413 02
XE	.13132103 09	YE	.70151174 08	ZE	-.48500000 02	DXE	-.14513920 02	DYE	.26176599 02	DZE	-.10142326-02
XT	.13103117 09	YT	.70424398 08	ZT	.69320000 04	DXT	-.15217255 C2	DYT	.25495959 02	DZT	.84321856-01
LTE	-.18664517-04	LOE	.28110954 02	LTT	.26699467-02	LOT	.28256379 C2	RST	.14875740 09	VST	.29692017 02
EPS	.10995750 03	ESP	.15686166 00	SEP	.69885278 02	EPM	.18260781 02	EMP	.16C00996 03	MEP	.17292532 01
MPS	.12583767 03	MSP	.98911702-02	SMP	.54150348 02	SEM	.71421761 02	EMS	.10843278 C3	ESM	.14536996 C0
EPT	.18260781 02	ETP	.16000996 03	TEP	.17292532 01	TPS	.12583767 03	TSP	.98911702-02	STP	.54150348 02
SET	.71421761 02	STE	.10843278 03	EST	.14536996 00	RPM	.38367850 C5	RPT	.38367850 05	SPN	.10911671 C3
GCE	.10187630 03	GCT	.91611537 02	SIP	.12324138 C3	CPT	.89344408 02	SIN	.86748117 02	C1	.13603467 C1
REP	.43464924 06	VEP	.18659601 01	CPE	.99972270 02	CPS	.93348859 C2	D2	.82621944 00	D3	.44569769-01

SELENOCENTRIC EQUATORIAL COORDINATES

X	-.34185532 05	Y	.12201268 05	Z	.12432634 C5	DX	-.11130805 01	DY	.25498660 00	DZ	.33282019 C0
R	.38367850 05	CEC	.18907291 02	RA	.16035784 03	V	.11894266 C1	PTH	.83048161 02	AZ	.11143226 03
R	.38367844 05	LAT	.10640291 02	LON	.20412057 03	VR	.11814959 C1	PTR	.87873263 02	AZR	.82575919 02
LTS	.15356809 01	LNS	.25788661 C3	LTE	-.13668258 01	LNE	.62930715 C1				
ALT	.36629850 05	SHA	-.31099313 05	ALP	.17280239 03	DR	.11806823 C1	DP	.21498230-03	ASD	.25962906 01
HGE	.25004249 03	SVL	.83060494 01	HNG	.23372244 03	SIA	.15664490 C2				

5 DAYS 11 HRS. 55 MIN. 52.000 SEC. JULIAN DATE 2437962.07777777 OCT. 24,1962 13 52 00.000
RECTIFICATION -.24361964-01 .16260057 05 -.59709147 04 -.58317370 04

19 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437976.5CCCCCCC NOV. 8,1962 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.22859175 C7	Y	-.59476698 06	Z	.12098452 06	DX	-.12436209 C1	DY	-.63197976 00	DZ	-.55525853-01
R	.23651224 07	CEC	.29321635 01	RA	.19458427 03	V	.13960925 C1	PTH	.76595502 02	AZ	.11275022 03
R	.23651224 07	LAT	.29321635 01	LON	.14788414 C3	VE	.17194858 C3	PTE	.45252991 CC	AZE	.26995829 03
XS	-.10460943 09	YS	-.96332643 08	ZS	-.41772475 08	DXS	.21590109 C2	DYS	-.19179855 02	DZS	-.83176409 01
XM	.35899962 06	YM	-.46619588 05	ZM	-.45810300 05	DXM	.13342950 C0	DYM	.10015464 01	DZM	.36753930 00
XT	.35899962 06	YT	-.46619588 05	ZT	-.45810300 05	DXT	.13342950 C0	DYT	.10015464 01	DZT	.36753930 CC
RS	.14821623 09	VS	.30053000 02	RM	.36490094 06	VM	.10751668 C1	RT	.36490094 C6	VT	.10751668 01
GED	.29521103 01	ALT	.23587442 07	LOS	.17594119 03	RAS	.22264132 C3	RAM	.35260099 03	LOM	.30590085 03
DUT	.34000000 02	DT	.30720000 05	DR	.13580598 01	SHA	-.13150117 C7	DES	-.16369734 02	DEM	-.72120428 01

CASE 1 SPACE TRAJECTORIES 29

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437972.25776955 NOV. 3,1962 18 11 11.289

SMA	-.24727144 06	ECC	.26353005 01	INC	.22928414 02	LAN	.21539205 02	APF	.74197808 02	RCA	.40436310 06
VH	.12696482 01	C3	.16120066 01	C1	.76546670 06	SLR	.14699814 07	APO	.00000000 00	TFP	.36652871 06
TA	.98257234 02	EA	.11835901 03	MA	.10783012 03	DAO	-.25269932 01	RAO	.20752793 03	MTA	.11230045 03
WX	.14303001 00	WY	-.36237551 00	WZ	.92099232 00	PX	-.72052029-01	PY	.92427827 00	PZ	.37485808 00
CX	-.98709214 00	QY	-.11997519 00	QZ	.10608962 00	RX	.39098443-01	RY	.20377598-01	RZ	-.99902754 00
SXO	-.88592321 00	SYO	-.46173161 00	SZO	-.44090076-01	TX	-.46218106 00	TY	.88678558 00	TZ	.00000000 00
BX	-.44122825 00	BY	.80962215 00	BZ	.38707828 00	MX	.21306888 00	MY	-.89746597 00	MZ	-.38620836 00
B.T	.55580368 06	B.R	-.23359540 06	B	.60289679 06	PER	.00000000 00	OMD	.12569685-05	NOD	-.71435381-06
C3J	-.30595385 01										

HELIOCENTRIC ECLIPTIC COORDINATES

X	.10232351 09	Y	.10450206 09	Z	.34796050 06	DX	-.22833729 02	DY	.20303836 02	DZ	.20121688 00
R	.14625629 09	LAT	.13631521 00	LON	.45603487 02	V	.30555939 02	PTH	-.27519301 01	AZ	.89615704 02
XE	.10460943 09	YE	.10499961 09	ZE	.34450000 03	DXE	-.21590109 02	DYE	.20905741 02	DZE	.73802470-03
XT	.10496843 09	YT	.10493861 09	ZT	-.23137500 05	DXT	-.21456679 02	DYT	.21970837 02	DZT	-.60506641-01
LTE	.13317297-03	LOE	.45106651 02	LTT	-.89315541-02	LOT	.44991859 02	RST	.14842669 09	VST	.30710102 02
EPS	.14570511 03	ESP	.51515036 00	SEP	.33779728 02	EPM	.29334318 01	EMP	.19371919 02	MEP	.15769463 03
MPS	.14300516 03	MSP	.62861796 00	SMP	.36366199 02	SEM	.12516661 03	EMS	.54718235 02	ESM	.11513766 00
EPT	.29334318 01	ETP	.19371919 02	TEP	.15769463 03	TPS	.14300516 03	TSP	.62861796 00	STP	.36366199 02
SET	.12516661 03	STE	.54718235 02	EST	.11513766 00	RPM	.27062654 07	RPT	.27062654 07	SPN	.14555060 03
GCE	.86861405 02	GCT	.88830759 02	SIP	.14296836 03	CPT	.83597189 02	SIN	.83560391 02	D1	.19266407-01
REP	.23651224 07	VEP	.13960925 01	CPE	.82336237 02	CPS	.97144445 02	D2	.15520060-01	D3	.16803274-04

HELIOCENTRIC CONIC ORBITAL B.T AND B.R ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2438034.07183666 JAN. 4,1963 13 43 26.688

SMA	.15061302 09	ECC	.56035325-01	INC	.40770429 00	LAN	.26073698 02	APF	.81242877 02	RCA	.14217336 09
VH	.28065198 02	C3	-.88116844 03	C1	.44638446 10	SLR	.15014010 09	APO	.15905266 09	TFP	-.49742067 07
TA	-.61712644 02	EA	-.58920886 02	MA	-.56171162 02	DAI	.40300165 00	RAI	.10731636 03	MTA	.18000000 03
WX	.31279418-02	WY	-.63923490-02	WZ	.99997468 00	PX	-.29763993 00	PY	.95465135 00	PZ	.70336431-02
CX	-.95467214 00	QY	-.29765441 00	QZ	.10834754-02	RX	-.20935467-02	RY	.67148490-02	RZ	-.99997435 00
SXI	-.29763993 00	SYI	.95465135 00	SZI	.70336431-02	TX	.95467582 00	TY	.29764756 00	TZ	.00000000 00
BX	.95467299 00	BY	.29765468 00	BZ	-.10834764-02	MX	-.71451040 00	MY	.69959269 00	MZ	.67071573-02
B.T	.15037614 09	B.R	.16293300 06	B	.15037623 09	PER	.36897689 03	DEF		C3J	

32 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2437989.50000000 NOV. 21,1962 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.37088180 07	Y	-.14156710 07	Z	-.54735000 04	DX	-.12764842 01	DY	-.85252845 00	DZ	-.18133283 00
R	.39698218 07	DEC	-.78999674-01	RA	.20089206 03	V	.15456709 01	PTH	.75557891 02	AZ	.11771276 03
R	.39698234 07	LAT	-.79004797-01	LON	.14137848 03	VE	.28914646 03	PTE	.29660523 00	AZE	.26996447 03
XS	-.77891151 08	YS	-.11522974 09	ZS	-.49965918 08	DXS	.25799910 02	DYS	-.14316229 02	DZS	-.62070252 01
XM	-.39592500 06	YM	.59116000 05	ZM	.54181000 05	DXM	-.19972444 00	DYM	-.89125359 00	DZM	-.32144642 00
XT	-.39592500 06	YT	.59116000 05	ZT	.54181000 05	DXT	-.19972444 00	DYT	-.89125359 00	DZT	-.32144642 00
RS	.14778876 09	VS	.30151566 02	RM	.40396397 06	VM	.96827196 00	RT	.40396397 06	VT	.96827196 00
GED	-.79543196-01	ALT	.39634436 07	LOS	.17642914 03	RAS	.23594272 03	RAM	.17150784 03	LOM	.11199425 03
DUT	.34000000 02	DT	.86399999 05	DR	.14968279 01	SHA	-.25285878 07	DES	-.19760554 02	DEM	.77079315 01

CASE 1 SPACE TRAJECTORIES 30

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.74182333 08	Y	.12429552 09	Z	.55791149 06	DX	-.27076394 02	DY	.14749597 02	DZ	.17205024 00
R	.14475050 09	LAT	.22083624 00	LON	.59170308 02	V	.30833607 02	PTH	-.22495057 01	AZ	.89671365 02
XE	.77891151 08	YE	.12559652 09	ZE	-.26400000 03	DXE	-.25799910 02	DYE	.15603896 02	DZE	-.74642896-03
XT	.77495226 08	YT	.12567231 09	ZT	.25926000 05	DXT	-.25999634 02	DYT	.14658326 02	DZT	.58907866-01
LTE	-.10234936-03	LOE	.58194066 02	LTT	.10060960-01	LOT	.58340141 02	RST	.14764498 09	VST	.29847127 02
EPS	.13943412 03	ESP	.10009288 01	SEP	.39564949 02	EPM	.32226244 01	EMP	.14646543 03	MEP	.30311952 02
MPS	.14251655 03	MSP	.85657989 00	SMP	.36626943 02	SEM	.69077197 02	EMS	.11077637 03	ESM	.14637599 00
EPT	.32226244 01	ETP	.14646543 03	TEP	.30311952 02	TPS	.14251655 03	TSP	.85657989 00	STP	.36626943 02
SET	.69077197 02	STE	.11077637 03	EST	.14637599 00	RPM	.36268189 07	RPT	.36268189 07	SPN	.13934206 03
GCE	.87412909 02	GCT	.85918780 02	SIP	.14248909 03	CPT	.79837685 02	SIN	.79810227 02	D1	.14376236-01
REP	.39698218 07	VEP	.15456709 01	CPE	.80968767 02	CPS	.99703381 02	D2	.11540760-01	D3	.92672163-05

62 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438019.50000000 DEC. 21,1962 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.68129385 07	Y	-.46061700 07	Z	-.10229940 07	DX	-.97450829 00	DY	-.16818810 01	DZ	-.64097070 00
R	.82873064 07	DEC	-.70907403 01	RA	.21406229 03	V	.20467617 01	PTH	.62473676 02	AZ	.11636886 03
R	.82873078 07	LAT	-.70907351 01	LON	.12497913 03	VE	.59885351 03	PTE	.17365927 00	AZE	.26995980 03
XS	-.35015344 07	YS	-.13498419 09	ZS	-.58531621 08	DXS	.30271261 02	DYS	-.56091802 00	DZS	-.24302874 00
XM	-.37629950 06	YM	-.14636600 06	ZM	-.23981000 05	DXM	.35389304 00	DYM	-.83091859 00	DZM	-.34579959 00
XT	-.37629950 06	YT	-.14636600 06	ZT	-.23981000 05	DXT	.35389304 00	DYT	-.83091859 00	DZT	-.34579959 00
RS	.14716977 09	VS	.30277433 02	RM	.40447423 06	VM	.96707980 00	RT	.40447423 06	VT	.96707980 00
GED	-.71385601 01	ALT	.82809285 07	LOS	.17943088 03	RAS	.26851406 03	RAM	.20125411 03	LOM	.11217094 03
DUT	.34000000 02	DT	.17280000 06	DR	.18150655 01	SHA	-.67601423 07	DES	-.23435408 02	DEM	-.33990205 01

HELIOCENTRIC ECLIPTIC COORDINATES

X	-.33114041 07	Y	.14249516 09	Z	.89349999 06	DX	-.31245770 02	DY	-.11867510 01	DZ	.80857459-01
R	.14253643 09	LAT	.35916549 00	LON	.91331241 02	V	.31268403 02	PTH	-.84292644 00	AZ	.89846533 02
XE	.35015344 07	YE	.14712811 09	ZE	-.41850000 03	DXE	-.30271261 02	DYE	.61130348 00	DZE	-.18119626-03
XT	.31252348 07	YT	.14698429 09	ZT	.35809000 05	DXT	-.29917368 02	DYT	-.28859982 00	DZT	.13126328-01
LTE	-.16292940-03	LOE	.88636659 02	LTT	.13955511-01	LOT	.88781937 02	RST	.14701751 09	VST	.29918763 02
EPS	.12262272 03	ESP	.27184108 01	SEP	.54658864 02	EPM	.67412905 00	EMP	.16605016 03	MEP	.13275685 02
MPS	.12328978 03	MSP	.25725479 01	SMP	.54137662 02	SEM	.67813645 02	EMS	.11204039 03	ESM	.14620880 00
EPT	.67412905 00	ETP	.16605016 03	TEP	.13275685 02	TPS	.12328978 03	TSP	.25725479 01	STP	.54137662 02
SET	.67813645 02	STE	.11204039 03	EST	.14620880 00	RPM	.78941876 07	RPT	.78941876 07	SPN	.12257863 03
GCE	.85683756 02	GCT	.85567551 02	SIP	.12327717 03	CPT	.79025842 02	SIN	.79013226 02	D1	.66048595-02
REP	.82873064 07	VEP	.20467617 01	CPE	.79227149 02	CPS	.10343564 03	D2	.38700798-02	D3	.10511651-05

92 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438049.50000000 JAN. 20,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.78561860 07	Y	-.99051560 07	Z	-.32521580 07	DX	.34487462 00	DY	-.22886691 01	DZ	-.10293047 01
R	.13054053 08	DEC	-.14426043 02	RA	.23158061 03	V	.25330639 01	PTH	.44818860 02	AZ	.10962635 03
R	.13054052 08	LAT	-.14426042 02	LON	.11292781 03	VE	.92021209 03	PTE	.11117072 00	AZE	.26996241 03
XS	.71823023 08	YS	-.11788523 09	ZS	-.51117419 08	DXS	.26498251 02	DYS	.13428426 02	DZS	.58223936 01
XM	-.24142000 06	YM	-.30426800 06	ZM	-.94956999 05	DXM	.79909205 00	DYM	-.50265706 00	DZM	-.25980955 00
XT	-.24142000 06	YT	-.30426800 06	ZT	-.94956999 05	DXT	.79909205 00	DYT	-.50265706 00	DZT	-.25980955 00
RS	.14720213 09	VS	.30271772 02	RM	.39984930 06	VM	.97913902 00	RT	.39984930 06	VT	.97913902 00
GED	-.14520210 02	ALT	.13047676 08	LOS	.18269955 03	RAS	.30135237 03	RAM	.23156992 03	LOM	.11291710 03
DUT	.34000000 02	DT	.17280000 06	DR	.17854751 01	SHA	-.11961196 08	DES	-.20319819 02	DEM	-.13737972 02

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	-.79679208 08	Y	.11810955 09	Z	.95646150 06	DX	-.26153376 02	DY	-.17145604 02	DZ	-.33385634-01
R	.14247651 09	LAT	.38463612 00	LON	.12400444 03	V	.31272542 02	PTH	.75600290 00	AZ	.90066250 02
XE	-.71823023 08	YE	.12849093 09	ZE	-.40600000 03	DXE	-.26498251 02	DYE	-.14636355 02	DZE	.45293569-03
XT	-.72064442 08	YT	.12817400 09	ZT	.33522500 05	DXT	-.25699158 02	DYT	-.15200883 02	DZT	-.37938416-01
LTE	-.15802819-03	LOE	.11920403 03	LTT	.13062085-01	LOT	.11934640 03	RST	.14704373 09	VST	.29858249 02
EPS	.10879575 03	ESP	.48157610 01	SEP	.66388476 02	EPM	.23196850-01	EMP	.17929010 03	MEP	.68813393 00
MPS	.10880213 03	MSP	.46727921 01	SMP	.66525067 02	SEM	.66591987 02	EMS	.11326503 03	ESM	.14333671 00
EPT	.23196850-01	ETP	.17929010 03	TEP	.68813393 00	TPS	.10880213 03	TSP	.46727921 01	STP	.66525067 02
SET	.66591987 02	STE	.11326503 03	EST	.14333671 00	RPM	.12654234 08	RPT	.12654234 08	SPN	.10876776 03
GCE	.80603649 02	GCT	.80625608 02	SIP	.10879426 03	CPT	.77142794 02	SIN	.77134924 02	D1	.41203602-02
REP	.13054053 08	VEP	.25330639 01	CPE	.77123346 02	CPS	.10295470 03	D2	.16415433-02	D3	.24577132-06

122 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438079.5000000 FEB. 19,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.46785260 07	Y	-.15390887 08	Z	-.58761365 07	DX	.20865162 01	DY	-.17179470 01	DZ	-.89301348 00
R	.17125916 08	DEC	-.20066691 02	RA	.25309176 03	V	.28464653 01	PTH	.26730038 02	AZ	.10095311 03
R	.17125916 08	LAT	-.20066690 02	LON	.10486953 03	VE	.11705339 04	PTE	.62669546-01	AZE	.26997635 03
XS	.12757452 09	YS	-.68610829 08	ZS	-.29751295 08	DXS	.15562702 02	DYS	.23677162 02	DZS	.10266053 02
XM	-.32467000 05	YM	-.36499900 06	ZM	-.13645775 06	DXM	.99914908 00	DYM	.82495212-02	DZM	-.82017898-01
XT	-.32467000 05	YT	-.36499900 06	ZT	-.13645775 06	DXT	.99914908 00	DYT	.82495212-02	DZT	-.82017898-01
RS	.14787780 09	VS	.30136316 02	RM	.39102313 06	VM	.10025437 01	RT	.39102313 06	VT	.10025437 01
GED	-.20192427 02	ALT	.17119540 08	LOS	.18350597 03	RAS	.33172820 03	RAM	.26491686 03	LOM	.11669464 03
DLT	.34000000 02	DT	.17280000 06	DR	.12803039 01	SHA	-.16580685 08	DES	-.11606460 02	DEM	-.20424704 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	-.13225305 09	Y	.58325380 08	Z	.73167749 06	DX	-.13476186 02	DY	-.27738386 02	DZ	-.13490152 00
R	.14454499 09	LAT	.29002861 00	LON	.15620187 03	V	.30838999 02	PTH	.21125032 01	AZ	.90261505 02
XE	-.12757452 09	YE	.74783589 08	ZE	-.25325000 03	DXE	-.15562702 02	DYE	-.25806972 02	DZE	.94056129-03
XT	-.12760699 09	YT	.74394431 08	ZT	.19762000 05	DXT	-.14563553 02	DYT	-.25832033 02	DZT	-.77589273-01
LTE	-.98122608-04	LOE	.14962137 03	LTT	.76655848-02	LOT	.14975796 03	RST	.14770943 09	VST	.29654629 02
EPS	.97909517 02	ESP	.65868600 01	SEP	.75503612 02	EPM	.25745581 00	EMP	.16864452 03	MEP	.11097897 02
MPS	.97652389 02	MSP	.64500549 01	SMP	.75897545 02	SEM	.64426424 02	EMS	.11543676 03	ESM	.13669873 00
EPT	.25745581 00	ETP	.16864452 03	TEP	.11097897 02	TPS	.97652389 02	TSP	.64500549 01	STP	.75897545 02
SET	.64426424 02	STE	.11543676 03	EST	.13669873 00	RPM	.16742374 08	RPT	.16742374 08	SPN	.97888178 02
GCE	.76278450 02	GCT	.76293818 02	SIP	.97646441 02	CPT	.75414679 02	SIN	.75408731 02	D1	.31142536-02
REP	.17125916 08	VEP	.28464653 01	CPE	.75369388 02	CPS	.98432384 02	D2	.75888483-03	D3	.81218529-07

152 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438109.5000000 MARCH 21,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.21027960 07	Y	-.17827058 08	Z	-.74086462 07	DX	.29265041 01	DY	-.45620679-01	DZ	-.23154283 00
R	.19419417 08	DEC	-.22427068 02	RA	.27672726 03	V	.29360040 01	PTH	.87593077 01	AZ	.91302449 02
R	.19419417 08	LAT	-.22427069 02	LON	.98935889 02	VE	.13060808 04	PTE	.19615449-01	AZE	.26999709 03
XS	.14900538 09	YS	-.80900845 06	ZS	-.35078198 06	DXS	.67276691 00	DYS	.27435205 02	DZS	.11895554 02
XM	.18559000 06	YM	-.30371588 06	ZM	-.13271467 06	DXM	.85987824 00	DYM	.55475903 00	DZM	.14120042 00
XT	.18559000 06	YT	-.30371588 06	ZT	-.13271467 06	DXT	.85987824 00	DYT	.55475903 00	DZT	.14120042 00
RS	.14900799 09	VS	.29910655 02	RM	.37986862 06	VM	.10329984 01	RT	.37986862 06	VT	.10329984 01
GED	-.22564629 02	ALT	.19413042 08	LOS	.18189755 03	RAS	.35968892 03	RAM	.30142762 03	LOM	.12363625 03
DUT	.34000000 02	DT	.17280000 06	DR	.44710622 00	SHA	-.19292452 08	DES	-.13488172 00	DEM	-.20448781 02

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	-.14690259 09	Y	-.18421193 08	Z	.29513256 06	DX	.22537372 01	DY	-.30037059 02	DZ	-.19318378 00
R	.14805336 09	LAT	.11421613 00	LON	.18714743 03	V	.30122111 02	PTH	.28556628 01	AZ	.90373613 02
XE	-.14900538 09	YE	.88178379 06	ZE	-.26589844 02	DXE	-.67276691 00	DYE	-.29903088 02	DZE	.10969639-02
XT	-.14881979 09	YT	.55033899 06	ZT	-.95699999 03	DXT	.18711134 00	DYT	-.29337946 02	DZT	-.90061545-01
LTE	-.10224188-04	LOE	.17966094 03	LTT	-.36844349-03	LOT	.17978812 03	RST	.14882081 09	VST	.29338681 02
EPS	.89068019 02	ESP	.74873609 01	SEP	.83444620 02	EPM	.44685877 00	EMP	.15650247 03	MEP	.23050659 02
MPS	.88621512 02	MSP	.73601972 01	SMP	.84018287 02	SEM	.60414711 02	EMS	.11945810 03	ESM	.12705441 00
EPT	.44685877 00	ETP	.15650247 03	TEP	.23050659 02	TPS	.88621512 02	TSP	.73601972 01	STP	.84018287 02
SET	.60414711 02	STE	.11945810 03	EST	.12705441 00	RPM	.19070458 08	RPT	.19070458 08	SPN	.89049200 02
GCE	.75070792 02	GCT	.75052807 02	SIP	.88616290 02	CPT	.75105365 02	SIN	.75100142 02	D1	.27340717-02
REP	.19419417 08	VEP	.29360040 01	CPE	.75107455 02	CPS	.91672063 02	D2	.28494629-03	D3	.26108588-07

182 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438139.5000000 APRIL 20,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.90916149 07	Y	-.15641205 08	Z	-.70252474 07	DX	.22424191 01	DY	.16504278 01	DZ	.49972093 00
R	.19407701 08	DEC	-.21221995 02	RA	.30016774 03	V	.28287941 01	PTH	-.93698250 01	AZ	.82646316 02
R	.19407700 08	LAT	-.21221997 02	LON	.92807288 02	VE	.13164897 04	PTE	-.20045751-01	AZE	.27001555 03
XS	.13117766 09	YS	.67283399 08	ZS	.29175955 08	DXS	-.14045479 02	DYS	.23965001 02	DZS	.10391087 02
XM	.33511200 06	YM	-.13260800 06	ZM	-.80528500 05	DXM	.37833965 00	DYM	.93586278 00	DZM	.33318996 00
XT	.33511200 06	YT	-.13260800 06	ZT	-.80528500 05	DXT	.37833965 00	DYT	.93586278 00	DZT	.33318996 00
RS	.15028596 09	VS	.29657570 02	RM	.36928278 06	VM	.10630125 01	RT	.36928278 06	VT	.10630125 01
GED	-.21353633 02	ALT	.19401325 08	LOS	.17979364 03	RAS	.27154108 02	RAM	.33841067 03	LOM	.13105021 03
DUT	.34000000 02	DT	.17280000 06	DR	-.46054561 00	SHA	.19402919 08	DES	.11194271 02	DEM	-.12595541 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	-.12208605 09	Y	-.90481862 08	Z	-.22250850 06	DX	.16287898 02	DY	-.24407793 02	DZ	-.19732344 00
R	.15196058 09	LAT	-.83896065-01	LON	.21654332 03	V	.29344078 02	PTH	.28277000 01	AZ	.90381610 02
XE	-.13117766 09	YE	-.73336840 08	ZE	.19175000 03	DXE	.14045479 02	DYE	-.26120795 02	DZE	.80633163-03
XT	-.13084255 09	YT	-.73490539 08	ZT	-.20933000 05	DXT	.14423819 02	DYT	-.25129627 02	DZT	-.65827607-01
LTE	.73103736-04	LOE	.20920802 03	LTT	-.79921532-02	LOT	.20932168 03	RST	.15006876 09	VST	.28974972 02
EPS	.81392269 02	ESP	.73357782 01	SEP	.91271953 02	EPM	.67369352 00	EMP	.14183529 03	MEP	.37491029 02
MPS	.80720688 02	MSP	.72220378 01	SMP	.92057271 02	SEM	.53915120 02	EMS	.12597094 03	ESM	.11364091 00
EPT	.67369352 00	ETP	.14183529 03	TEP	.37491029 02	TPS	.80720688 02	TSP	.72220378 01	STP	.92057271 02
SET	.53915120 02	STE	.12597094 03	EST	.11364091 00	RPM	.19116015 08	RPT	.19116015 08	SPN	.81373437 02
GCE	.77485818 02	GCT	.77432042 02	SIP	.80715478 02	CPT	.76792108 02	SIN	.76786898 02	D1	.27275559-02
REP	.19407701 08	VEP	.28287941 01	CPE	.76883726 02	CPS	.84798141 02	D2	.97923884-04	D3	.89080285-08

212 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438169.5000000 MAY 20,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.12858863 08	Y	-.10197149 08	Z	-.51700245 07	DX	.59277105 00	DY	.23635157 01	DZ	.85741550 00
R	.17206433 08	DEC	-.17485859 02	RA	.32158539 03	V	.25831658 01	PTH	-.28065695 02	AZ	.76913942 02
R	.17206433 08	LAT	-.17485859 02	LON	.84655629 02	VE	.11945145 04	PTE	-.58295663-01	AZE	.27002475 03
XS	.79584970 08	YS	.11814162 09	ZS	.51229326 08	DXS	-.24856712 02	DYS	.14478174 02	DZS	.62780137 01
XM	.35127600 06	YM	.90453999 05	ZM	.44365000 04	DXM	-.29360056 00	DYM	.96003687 00	DZM	.40498602 00
XT	.35127600 06	YT	.90453999 05	ZT	.44365000 04	DXT	-.29360056 00	DYT	.96003687 00	DZT	.40498602 00
RS	.15137917 09	VS	.29442947 02	RM	.36276223 06	VM	.10825367 01	RT	.36276223 06	VT	.10825367 01
GED	-.17597690 02	ALT	.17200057 08	LOS	.17910444 03	RAS	.56034199 02	RAM	.14440028 02	LOM	.13751027 03
DUT	.34000000 02	DT	.17280000 06	DR	-.12153372 01	SHA	.16952094 08	DES	.19780473 02	DEM	.70073130 00

CASE 1 SPACE TRAJECTORIES 33

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	-.66726107 08	Y	-.14018293 09	Z	-.68617300 06	DX	.25449483 02	DY	-.13271182 02	DZ	-.15351617 00
R	.15525495 09	LAT	-.25322926 00	LON	.24454587 03	V	.28702335 02	PTH	.20879384 01	AZ	.90297424 02
XE	-.79584970 08	YE	-.12877067 09	ZE	.30700000 03	DXE	.24856712 02	DYE	-.15780715 02	DZE	.13393163-03
XT	-.79233694 08	YT	-.12868592 09	ZT	-.31608000 05	DXT	.24563112 02	DYT	-.14738805 02	DZT	-.10246217-01
LTE	.11619699-03	LOE	.23828242 03	LTT	-.11983679-01	LOT	.23837882 03	RST	.15112261 09	VST	.28645749 02
EPS	.73867856 02	ESP	.62685519 01	SEP	.99863590 02	EPM	.10026135 01	EMP	.12390244 03	MEP	.55094908 02
MPS	.72867866 02	MSP	.61717519 01	SMP	.10096038 03	SEM	.44941787 02	EMS	.13496106 03	ESM	.97917601-01
EPT	.10026135 01	ETP	.12390244 03	TEP	.55094908 02	TPS	.72867866 02	TSP	.61717519 01	STP	.10096038 03
SET	.44941787 02	STE	.13496106 03	EST	.97917601-01	RPM	.17001457 08	RPT	.17001457 08	SPN	.73846615 02
GCE	.83113614 02	GCT	.83037467 02	SIP	.72862010 02	CPT	.80332250 02	SIN	.80326393 02	D1	.30667959-02
REP	.17206433 08	VEP	.25831658 01	CPE	.80548365 02	CPS	.79425173 02	D2	.58314894-03	D3	.60714817-07

242 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438199.5000000 JUNE 19,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.12288543 08	Y	-.44811540 07	Z	-.30220610 07	DX	-.94496250 00	DY	.18976039 01	DZ	.74022833 00
R	.13424674 08	DEC	-.13009488 02	RA	.33996505 03	V	.22453937 01	PTH	-.47862592 02	AZ	.75584648 02
R	.13424674 08	LAT	-.13009489 02	LON	.73465700 02	VE	.95235845 03	PTE	-.10017326 00	AZE	.27002256 03
XS	.79039901 07	YS	.13927858 09	ZS	.60394824 08	DXS	-.29271910 02	DYS	.15260613 01	DZS	.66241972 00
XM	.21896806 06	YM	.27550800 06	ZM	.88907500 05	DXM	-.86212182 00	DYM	.57879233 00	DZM	.30860281 00
XT	.21896806 06	YT	.27550800 06	ZT	.88907500 05	DXT	-.86212182 00	DYT	.57879233 00	DZT	.30860281 00
RS	.15201490 09	VS	.29319147 02	RM	.36298238 06	VM	.10832776 01	RT	.36298238 06	VT	.10832776 01
GED	-.13095101 02	ALT	.13418297 08	LOS	.18025262 03	RAS	.86751974 02	RAM	.51523045 02	LOM	.14502369 03
DUT	.34000000 02	DT	.17280000 06	DR	-.16650447 01	SHA	.12587180 08	DES	.23409209 02	DEM	.14178059 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.43845530 07	Y	-.15712283 09	Z	-.98958000 06	DX	.28326948 02	DY	.37182941 00	DZ	-.76426699-01
R	.15718710 09	LAT	-.36071168 00	LON	.27159844 03	V	.28329491 02	PTH	.84734984 00	AZ	.90149255 02
XE	-.79039901 07	YE	-.15180928 09	ZE	.27000000 03	DXE	.29271910 02	DYE	-.16636293 01	DZE	-.62069296-03
XT	-.76850221 07	YT	-.15152114 09	ZT	-.27768000 05	DXT	.28409788 02	DYT	-.10098392 01	DZT	.52245139-01
LTE	.10176542-03	LOE	.26701956 03	LTT	-.10486634-01	LOT	.26709649 03	RST	.15171590 09	VST	.28427778 02
EPS	.65061820 02	ESP	.45930398 01	SEP	.11034515 03	EPM	.15120670 01	EMP	.10259279 03	MEP	.75895106 02
MPS	.63550602 02	MSP	.45155207 01	SMP	.11193388 03	SEM	.34502926 02	EMS	.14541942 03	ESM	.78196572-01
EPT	.15120670 01	ETP	.10259279 03	TEP	.75895106 02	TPS	.63550602 02	TSP	.45155207 01	STP	.11193388 03
SET	.34502926 02	STE	.14541942 03	EST	.78196572-01	RPM	.13340862 08	RPT	.13340862 08	SPN	.65034598 02
GCE	.91285983 02	GCT	.91228744 02	SIP	.63543138 02	CPT	.85128631 02	SIN	.85121167 02	D1	.39082932-02
REP	.13424674 08	VEP	.22453937 01	CPE	.85510750 02	CPS	.76551101 02	D2	.14600660-02	D3	.20503022-06

272 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438229.5000000 JULY 19,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.87822919 07	Y	-.93753000 06	Z	-.15711615 07	DX	-.16111827 01	DY	.80653405 00	DZ	.36938357 00
R	.89708507 07	DEC	-.10086849 02	RA	.35390662 03	V	.18392528 01	PTH	-.69815784 02	AZ	.83840650 02
R	.89708501 07	LAT	-.10086848 02	LON	.57837573 02	VE	.64342490 03	PTE	-.15372536 00	AZE	.27000606 03
XS	-.65764808 08	YS	.12576509 09	ZS	.54535413 08	DXS	-.26383382 02	DYS	-.11724153 02	DZS	-.50827619 01
XM	-.86080000 04	YM	.34380400 06	ZM	.13688000 06	DXM	-.10605814 01	DYM	-.33666134-01	DZM	.85401296-01
XT	-.86080000 04	YT	.34380400 06	ZT	.13688000 06	DXT	-.10605814 01	DYT	-.33666134-01	DZT	.85401296-01
RS	.15203940 09	VS	.29315066 02	RM	.37015054 06	VM	.10645467 01	RT	.37015054 06	VT	.10645467 01
GED	-.10154162 02	ALT	.89644731 07	LOS	.18153682 03	RAS	.11760587 03	RAM	.91434245 02	LOM	.15536520 03
DUT	.34000000 02	DT	.17280000 06	DR	-.17263009 01	SHA	.73538076 07	DES	.21019927 02	DEM	.21703005 02

CASE 1 SPACE TRAJECTORIES 34

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.74547100 08	Y	-.13856536 09	Z	-.10683825 07	DX	.24772199 02	DY	.13665421 02	DZ	.16938448-01
R	.15734920 09	LAT	-.38903476 00	LON	.29827990 03	V	.28291445 02	PTH	-.60334475 00	AZ	.89969787 02
XE	.65764808 08	YE	-.13708015 09	ZE	.10600000 03	DXE	.26383382 02	DYE	.12778507 02	DZE	-.10859370-02
XT	.65756200 08	YT	-.13671027 09	ZT	-.11090500 05	DXT	.25322801 02	DYT	.12781595 02	DZT	.90659558-01
LTE	.39945912-04	LOE	.29562957 03	LTT	-.41887234-02	LOT	.29568706 03	RST	.15170226 09	VST	.28365853 02
EPS	.52380519 02	ESP	.26787155 01	SEP	.12494075 03	EPM	.23046707 01	EMP	.77057363 02	MEP	.10063796 03
MPS	.50076946 02	MSP	.26212300 01	SMP	.12730182 03	SEM	.24354408 02	EMS	.15558794 03	ESM	.57674939-01
EPT	.23046707 01	ETP	.77057363 02	TEP	.10063796 03	TPS	.50076946 02	TSP	.26212300 01	STP	.12730182 03
SET	.24354408 02	STE	.15558794 03	EST	.57674939-01	RPM	.90464990 07	RPT	.90464990 07	SPN	.52339783 02
GCE	.10179331 03	GCT	.10188449 03	SIP	.50065940 02	CPT	.90305098 02	SIN	.90294090 02	D1	.57635556-02
REP	.89708507 07	VEP	.18392528 01	CPE	.90940463 02	CPS	.76635930 02	D2	.34933272-02	D3	.84358129-06

277 DAYS 1 HRS. 32 MIN. 15.287 SEC. JULIAN DATE 2438233.64471397 JULY 23,1963 03 28 23.287
RECTIFICATION -.93751343-02 .24396987 07 .29276218 07 .13364548 07

289 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438246.50000000 AUG. 5,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.64413390 07	Y	-.20273600 06	Z	-.11821415 07	DX	-.15404861 01	DY	.23252583 00	DZ	.17680949 00
R	.65520537 07	DEC	-.10394403 02	RA	.35819725 03	V	.15679372 01	PTH	-.82232463 02	AZ	.11976829 03
R	.65520541 07	LAT	-.10394401 02	LON	.45372136 02	VE	.46976109 03	PTE	-.18948481 00	AZE	.26998716 03
XS	-.10130672 09	YS	.10367421 09	ZS	.44956386 08	DXS	-.21683536 02	DYS	-.18137615 02	DZS	-.78662705 01
XM	.22958000 06	YM	-.27613300 06	ZM	-.13060550 06	DXM	.79192114 00	DYM	.63939571 00	DZM	.18010169 00
XT	.22958000 06	YT	-.27613300 06	ZT	-.13060550 06	DXT	.79192114 00	DYT	.63939571 00	DZT	.18010169 00
RS	.15176452 09	VS	.29343262 02	RM	.38211805 06	VM	.10336356 01	RT	.38211805 06	VT	.10336356 01
GED	-.10463677 02	ALT	.65456761 07	LOS	.18151314 03	RAS	.13433827 03	RAM	.30974051 03	LOM	.35691538 03
DUT	.34000000 02	DT	.17280000 06	DR	-.15535508 01	SHA	.44721719 07	DES	.17230983 02	DEM	-.19986186 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.10774806 09	Y	-.11365815 09	Z	-.10037865 07	DX	.20143050 02	DY	.20053632 02	DZ	.70816933-01
R	.15661681 09	LAT	-.36722170 00	LON	.31347094 03	V	.28423505 02	PTH	-.14024846 01	AZ	.89866190 02
XE	.10130672 09	YE	-.11300185 09	ZE	.11900000 03	DXE	.21683536 02	DYE	.19769959 02	DZE	.11098981-02
XT	.10153630 09	YT	-.11330715 09	ZT	-.98495000 04	DXT	.22475457 02	DYT	.20428227 02	DZT	-.88031112-01
LTE	.44926163-04	LOE	.31187638 03	LTT	-.37091880-02	LOT	.31186401 03	RST	.15214509 09	VST	.30372131 02
EPS	.41407740 02	ESP	.16363045 01	SEP	.13695596 03	EPM	.25656815 01	EMP	.12986394 03	MEP	.47570357 02
MPS	.43968946 02	MSP	.16475231 01	SMP	.13438353 03	SEM	.17484519 03	EMS	.51418753 01	ESM	.13988227-01
EPT	.25656815 01	ETP	.12986394 03	TEP	.47570357 02	TPS	.43968946 02	TSP	.16475231 01	STP	.13438353 03
SET	.17484519 03	STE	.51418753 01	EST	.13988227-01	RPM	.63005606 07	RPT	.63005606 07	SPN	.41351965 02
GCE	.10994056 03	GCT	.10971672 03	SIP	.43953140 02	CPT	.94559876 02	SIN	.94544069 02	D1	.82754543-02
REP	.65520537 07	VEP	.15679372 01	CPE	.93711732 02	CPS	.78002387 02	D2	.57894728-02	D3	.22341696-05

CASE 1 — SPACE TRAJECTORIES — 35

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC — CONIC — ORBITAL B.T AND B.R — ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE — JULIAN DATE 2438399.68904224 — JAN. 5,1964 04 32 13.250

SMA	.14964250 09	ECC	.52630144-01	INC	.39079587 00	LAN	.23450232 02	APF	.83709337 02	RCA	.14176680 09
VH	.28252384 02	C3	-.88688327 03	C1	.44502652 10	SLR	.14922801 09	APO	.15751821 09	TFP	-.13235533 08
TA	-.15368906 03	EA	-.15231927 03	MA	-.15091845 03	DAI	.38848579 00	RAI	.10715943 03	MTA	.18000000 03
WX	.27145895-02	WY	-.62579883-02	WZ	.99997674 00	PX	-.29502376 00	PY	.95546243 00	PZ	.67802989-02
QX	-.95548264 00	QY	-.29503529 00	QZ	.74743316-03	RX	-.20004018-02	RY	.64784910-02	RZ	-.99997374 00
SXI	-.29502376 00	SYI	.95546243 00	SZI	.67802989-02	TX	.95548753 00	TY	.29503151 00	TZ	.00000000 00
BX	.95548576 00	BY	.29503625 00	BZ	-.74743560-03	MX	.72573169 00	MY	.68797387 00	MZ	.23353232-02
B.T	.14943458 09	B.R	.11169495 06	B	.14943462 09	PER	.36541625 03	DEF		C3J	

309 DAYS 22 HRS. 3 MIN. 52.000 SEC. — JULIAN DATE 2438266.50000000 — AUG. 25,1963 00 00 00.000

GEOCENTRIC — EQUATORIAL COORDINATES

X	.39888710 07	Y	-.25228400 06	Z	-.10120035 07	DX	-.12489150 01	DY	-.24149203 00	DZ	.38301348-01
R	.41229710 07	DEC	-.14208719 02	RA	.35638103 03	V	.12726248 01	PTH	-.70948598 02	AZ	.23034976 03
R	.41229727 07	LAT	-.14208709 02	LON	.23843124 02	VE	.29177682 03	PTE	-.23621611 00	AZE	.26994794 03
XS	-.13238624 09	YS	.67070529 08	ZS	.29084615 08	DXS	-.13906752 02	DYS	-.23834971 02	DZS	-.10336039 02
XM	-.32516600 06	YM	-.23172600 06	ZM	-.62505499 05	DXM	.56057870 00	DYM	-.71486688 00	DZM	-.33598340 00
XT	-.32516600 06	YT	-.23172600 06	ZT	-.62505499 05	DXT	.56057870 00	DYT	-.71486688 00	DZT	-.33598340 00
RS	.15122592 09	VS	.29467563 02	RM	.40414948 06	VM	.96859071 00	RT	.40414948 06	VT	.96859071 00
GED	-.14301579 02	ALT	.41165941 07	LOS	.18059405 03	RAS	.15313197 03	RAM	.21547515 03	LOM	.24293724 03
DUT	.34000000 02	DT	.17280000 06	DR	-.12029182 01	SHA	.16035353 07	DES	.11088238 02	DEM	-.88970419 01

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.13637511 09	Y	-.73739278 08	Z	-.82848974 06	DX	.12657837 02	DY	.25773278 02	DZ	.13152742 00
R	.15503658 09	LAT	-.30618201 00	LON	.33159950 03	V	.28714108 02	PTH	-.22451498 01	AZ	.89749348 02
XE	.13238624 09	YE	-.73105202 08	ZE	-.39200000 03	DXE	.13906752 02	DYE	.25979598 02	DZE	.31208992-03
XT	.13206108 09	YT	-.73342668 08	ZT	.34452500 05	DXT	.14467331 02	DYT	.25190073 02	DZT	-.23533821-01
LTE	-.14851522-03	LOE	.33109201 03	LTT	.13067497-01	LOT	.33095355 03	RST	.15106051 09	VST	.29048992 02
EPS	.22295138 02	ESP	.59256547 00	SEP	.15711224 03	EPM	.37184828 01	EMP	.41423374 02	MEP	.13485813 03
MPS	.25470198 02	MSP	.72056818 00	SMP	.15380926 03	SEM	.65147451 02	EMS	.11471345 03	ESM	.13900529 00
EPT	.37184828 01	ETP	.41423374 02	TEP	.13485813 03	TPS	.25470198 02	TSP	.72056818 00	STP	.15380926 03
SET	.65147451 02	STE	.11471345 03	EST	.13900529 00	RPM	.44173390 07	RPT	.44173390 07	SPN	.22206504 02
GCE	.13156857 03	GCT	.12677680 03	SIP	.25447657 02	CPT	.96225590 02	SIN	.96203046 02	D1	.11803487-01
REP	.41229710 07	VEP	.12726248 01	CPE	.95690629 02	CPS	.80715933 02	D2	.10593458-01	D3	.94418628-05

329 DAYS 22 HRS. 3 MIN. 52.000 SEC. — JULIAN DATE 2438286.50000000 — SEPT. 14,1963 00 00 00.000

GEOCENTRIC — EQUATORIAL COORDINATES

X	.20989176 07	Y	-.81462337 06	Z	-.95266262 06	DX	-.96788974 00	DY	-.37747117 00	DZ	.45900522-01
R	.24447152 07	DEC	-.22934742 02	RA	.33878797 03	V	.10399047 01	PTH	-.44054598 02	AZ	.24995829 03
R	.24447151 07	LAT	-.22934742 02	LON	.34653721 03	VE	.16488283 03	PTE	-.25127070 00	AZE	.26991099 03
XS	-.14842212 09	YS	.22867139 08	ZS	.99161087 07	DXS	-.44560193 01	DYS	-.26861413 02	DZS	-.11646965 02
XM	-.21823618 06	YM	.28561684 06	ZM	.13408689 06	DXM	-.86100241 00	DYM	-.53926544 00	DZM	-.13774997 00
XT	-.21823618 06	YT	.28561684 06	ZT	.13408689 06	DXT	-.86100241 00	DYT	-.53926544 00	DZT	-.13774997 00
RS	.15050037 09	VS	.29614919 02	RM	.38364476 06	VM	.10252353 01	RT	.38364476 06	VT	.10252353 01
GED	-.23074723 02	ALT	.24383402 07	LOS	.17899064 03	RAS	.17124140 03	RAM	.12738298 03	LOM	.13513222 03
DUT	.34000000 02	DT	.76800000 04	DR	-.72309104 00	SHA	.94071488 06	DES	.37778186 01	DEM	.20457220 02

CASE 1 SPACE TRAJECTORIES 36

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.15052104 09	Y	-.26050979 08	Z	-.54998637 06	DX	.34881295 01	DY	.28949710 02	DZ	.19122934 00
R	.15275974 09	LAT	-.20628452 00	LON	.35018097 03	V	.29159721 02	PTH	-.29498921 01	AZ	.89634381 02
XE	.14842212 09	YE	-.24924591 08	ZE	-.54375000 02	DXE	.44560193 01	DYE	.29277761 02	DZE	-.10563135-02
XT	.14820388 09	YT	-.24609205 08	ZT	.93337499 04	DXT	.35950169 01	DYT	.28728207 02	DZT	.87107181-01
LTE	-.20700666-04	LOE	.35046723 03	LTT	.35596964-02	LOT	.35057207 03	RST	.15023316 09	VST	.28952402 02
EPS	.22278192 02	ESP	.35290886 00	SEP	.15736897 03	EPM	.38560262 01	EMP	.25374768 02	MEP	.15076920 03
MPS	.24692645 02	MSP	.44383810 00	SMP	.15486351 03	SEM	.45802017 02	EMS	.13409308 03	ESM	.10491172 00
EPT	.38560262 01	ETP	.25374768 02	TEP	.15076920 03	TPS	.24692645 02	TSP	.44383810 00	STP	.15486351 03
SET	.45802017 02	STE	.13409308 03	EST	.10491172 00	RPM	.27858130 07	RPT	.27858130 07	SPN	.22128712 02
GCE	.24718462 03	GCT	.25474307 03	SIP	.24656858 02	CPT	.91211297 02	SIN	.91175549 02	D1	.18716263-01
REP	.24447152 07	VEP	.10399047 01	CPE	.93233486 02	CPS	.84424682 02	D2	.16948292-01	D3	.24885636-04

337 DAYS 13 HRS. 59 MIN. 14.955 SEC. JULIAN DATE 2438294.16346013 SEPT. 21,1963 15 55 22.955
RECTIFICATION .18183743-01 .50584032 05 -.27987207 04 .39957711 04

347 DAYS 4 HRS. 23 MIN. 14.955 SEC. JULIAN DATE 2438303.76346012 OCT. 1,1963 06 19 22.955
RECTIFICATION -.68011072-02 .33475612 05 .24350730 05 .15332577 05

349 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438306.50000000 OCT. 4,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.54020428 06	Y	-.13460675 07	Z	-.76691420 06	DX	-.90640287 00	DY	-.18133236 00	DZ	.19162329 00
R	.16406936 07	DEC	-.27867790 02	RA	.29186660 03	V	.94401646 00	PTH	-.14680297 02	AZ	.27567257 03
R	.16406936 07	LAT	-.27867790 02	LON	.27990321 03	VE	.10667533 03	PTE	-.12849635 00	AZE	.27004848 03
XS	-.14735758 09	YS	-.23962975 08	ZS	-.10391779 08	DXS	.56812492 01	DYS	-.26801485 02	DZS	-.11622051 02
XM	.33445353 06	YM	.13218172 06	ZM	.23167645 05	DXM	-.40815426 00	DYM	.92633782 00	DZM	.41163870 00
XT	.33445353 06	YT	.13218172 06	ZT	.23167645 05	DXT	-.40815426 00	DYT	.92633782 00	DZT	.41163870 00
RS	.14965450 09	VS	.29760179 02	RM	.36037190 06	VM	.10927662 01	RT	.36037190 06	VT	.10927662 01
GED	-.28028896 02	ALT	.16343202 07	LOS	.17727308 03	RAS	.18923646 03	RAM	.21564776 02	LOM	.96013970 01
DUT	.34000000 02	DT	.15360000 05	DR	-.23923768 00	SHA	.16194570 07	DES	-.39817347 01	DEM	.36859816 01

HELIOCENTRIC ECLIPTIC COORDINATES

X	.14789778 09	Y	.24579145 08	Z	-.16762600 06	DX	-.65876520 01	DY	.29122740 02	DZ	.24783981 00
R	.14992637 09	LAT	-.64061196-01	LON	.94357538 01	V	.29859547 02	PTH	-.33106370 01	AZ	.89527339 02
XE	.14735758 09	YE	.26119211 08	ZE	.45787500 03	DXE	-.56812492 01	DYE	.29212868 02	DZE	-.10752678-03
XT	.14769203 09	YT	.26249699 08	ZT	-.30874500 05	DXT	-.60894034 01	DYT	.30226507 02	DZT	.90142488-02
LTE	.17529913-03	LOE	.10051314 02	LTT	-.11792670-01	LOT	.10078094 02	RST	.15000661 09	VST	.30833790 02
EPS	.80152483 02	ESP	.61889315 00	SEP	.99228612 02	EPM	.12317582 02	EMP	.76226761 02	MEP	.91455649 02
MPS	.92401250 02	MSP	.64448734 00	SMP	.86954284 02	SEM	.16769585 03	EMS	.12274820 02	ESM	.28837468-01
EPT	.12317582 02	ETP	.76226761 02	TEP	.91455649 02	TPS	.92401250 02	TSP	.64448734 00	STP	.86954284 02
SET	.16769585 03	STE	.12274820 02	EST	.28837468-01	RPM	.16887224 07	RPT	.16887224 07	SPN	.79929750 02
GCE	.27816164 03	GCT	.27946716 03	SIP	.92342280 02	CPT	.80592693 02	SIN	.80533724 02	D1	.30875428-01
REP	.16406936 07	VEP	.94401646 00	CPE	.81759778 02	CPS	.88834739 02	D2	.16421831-02	D3	.16907558-05

357 DAYS 5 HRS. 43 MIN. 36.200 SEC. JULIAN DATE 2438313.81926157 OCT. 11,1963 07 39 44.200

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.45776424 05	Y	-.14280931 07	Z	-.62767404 06	DX	-.94190401 00	DY	-.77878036-01	DZ	.24588253 00
R	.15606153 07	DEC	-.23715566 02	RA	.26816405 03	V	.97657891 00	PTH	.10928119-06	AZ	.28596216 03
R	.15606153 07	LAT	-.23715566 02	LON	.13405230 03	VE	.10513094 03	PTE	-.48371003-06	AZE	.27014636 03
XS	-.14261027 09	YS	-.40683096 08	ZS	-.17641680 08	DXS	.93222710 01	DYS	-.26006106 02	DZS	-.11276106 02
XM	-.22502052 06	YM	.28049827 06	ZM	.13420267 06	DXM	-.85277440 00	DYM	-.54335948 00	DZM	-.14227442 00
XT	-.22502052 06	YT	.28049827 06	ZT	.13420267 06	DXT	-.85277440 00	DYT	-.54335948 00	DZT	-.14227442 00
RS	.14934535 09	VS	.29839116 02	RM	.38382792 06	VM	.10211296 01	RT	.38382792 06	VT	.10211296 01
GED	-.23859187 02	ALT	.15542406 07	LOS	.61810344 02	RAS	.19592210 03	RAM	.12873718 03	LCM	.35462543 03
DUT	.34000000 02	DT	.15360000 05	DR	.25030191-08	SHA	-.14760045 07	DES	-.67840050 01	DEM	.20465469 02

GEOCENTRIC — CONIC — ORBITAL B.T AND B.R — EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE — JULIAN DATE 2438313.81926147 — OCT. 11,1963 07 39 44.191

SMA	-.90002915 06	ECC	.27339608 01	INC	.15167288 03	LAN	.21358342 03	APF	.30204701 03	RCA	.15606153 07
VH	.66549087 00	C3	.44287809 00	C1	.15240640 07	SLR	.58272764 07	APO	.00000000 00	TFP	.88201469-02
TA	.25613208-05	EA	.00000000 00	MA	.37366633-06	DAO	.22423143 02	RAO	.16363258 03	MTA	.11145496 03
WX	-.26247269 00	WY	.39530119 00	WZ	-.88025284 00	PX	-.29332288-01	PY	-.91508337 00	PZ	-.40219652 00
QX	-.96449348 00	QY	-.79745768-01	QZ	.25177947 00	RX	-.36598555 00	RY	.10748933 00	RZ	-.92439199 00
SXO	-.88693041 00	SYO	.26048994 00	SZO	.38144381 00	TX	.28179597 00	TY	.95947435 00	TZ	.00000000 00
BX	-.38008221 00	BY	-.88084161 00	BZ	-.28223317 00	MX	-.96449350 00	MY	-.79745767-01	MZ	.25177948 00
B.T	-.21807823 07	B.R	.69921851 06	B	.22901350 07	PER	.00000000 00	OMD	.10214490-07	NOD	.62565268-08
C3J	.83124927 01										

HELIOCENTRIC — ECLIPTIC COORDINATES

X	.14256450 09	Y	.42783543 08	Z	-.77651250 04	DX	-.10264175 02	DY	.28371885 02	DZ	.25552714 00
R	.14884578 09	LAT	-.29890593-02	LON	.16704476 02	V	.30172545 02	PTH	-.31841761 01	AZ	.89514180 02
XE	.14261027 09	YE	.44343467 08	ZE	-.59999999 02	DXE	-.93222710 01	DYE	.28345513 02	DZE	-.10420084-02
XT	.14238525 09	YT	.44654203 08	ZT	.11470250 05	DXT	-.10175045 02	DYT	.27790403 02	DZT	.84599493-01
LTE	-.23018773-04	LOE	.17272642 02	LTT	.44041206-02	LOT	.17412225 02	RST	.14922318 09	VST	.29594682 02
EPS	.10838511 03	ESP	.56816375 00	SEP	.71046718 02	EPM	.71603924 01	EMP	.30451373 02	MEP	.14238823 03
MPS	.10123056 03	MSP	.70779359 00	SMP	.78061654 02	SEM	.71371033 02	EMS	.10848931 03	ESM	.13953216 00
EPT	.71603924 01	ETP	.30451373 02	TEP	.14238823 03	TPS	.10123056 03	TSP	.70779359 00	STP	.78061654 02
SET	.71371033 02	STE	.10848931 03	EST	.13953216 00	RPM	.18793268 07	RPT	.18793268 07	SPN	.10815095 03
GCE	.28386173 03	GCT	.28356232 03	SIP	.10117757 03	CPT	.76592050 02	SIN	.76539061 02	D1	.27743990-01
REP	.15606153 07	VEP	.97657891 00	CPE	.76680167 02	CPS	.90553370 02	D2	.57442898-02	D3	.54248483-05

369 DAYS 22 HRS. 3 MIN. 52.000 SEC. — JULIAN DATE 2438326.50000000 — OCT. 24,1963 00 00 00.000

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.10927474 07	Y	-.14168706 07	Z	-.32518465 06	DX	-.97566693 00	DY	.84108518-01	DZ	.29419546 00
R	.18186161 07	DEC	-.10300387 02	RA	.23235914 03	V	.10225239 01	PTH	.27245445 02	AZ	.29499272 03
R	.18186160 07	LAT	-.10300387 02	LON	.20068298 03	VE	.13130366 03	PTE	.20426790 00	AZE	.27016760 03
XS	-.12905419 09	YS	-.67976667 08	ZS	-.29477281 08	DXS	.15329369 02	DYS	-.23601408 02	DZS	-.10235587 02
XM	.71671637 05	YM	-.36122305 06	ZM	-.15408527 06	DXM	.95189480 00	DYM	.23479961 00	DZM	.75681849-02
XT	.71671637 05	YT	-.36122305 06	ZT	-.15408527 06	DXT	.95189480 00	DYT	.23479961 00	DZT	.75681849-02
RS	.14881103 09	VS	.29946339 02	RM	.39920068 06	VM	.98045491 00	RT	.39920068 06	VT	.98045491 00
GED	-.10369064 02	ALT	.18122385 07	LOS	.17610093 03	RAS	.20777710 03	RAM	.28122252 03	LOM	.24954635 03
DUT	.34000000 02	DT	.15360000 05	DR	.46811473 00	SHA	-.74435272 06	DES	-.11425018 02	DEM	-.22704872 02

CASE 1 SPACE TRAJECTORIES 38

RA-5 POSTMIDCOURSE ORBIT

HELIOCENTRIC ECLIPTIC COORDINATES

X	.12796144 09	Y	.72663475 08	Z	.26540000 06	DX	-.16305038 02	DY	.25919559 02	DZ	.23748863 00
R	.14715360 09	LAT	.10333734 00	LON	.29590266 02	V	.30622446 02	PTH	-.25813282 01	AZ	.89550535 02
XE	.12905419 09	YE	.74092761 08	ZE	.50749999 02	DXE	-.15329369 02	DYE	.25725351 02	DZE	.10397434-02
XT	.12912586 09	YT	.73700053 08	ZT	.23947500 04	DXT	-.14377474 02	DYT	.25943779 02	DZT	-.85430025-01
LTE	.19539955-04	LOE	.29861049 02	LTT	.92285577-03	LOT	.29716052 02	RST	.14867813 09	VST	.29661401 02
EPS	.15554954 03	ESP	.28981328 00	SEP	.24160634 02	EPM	.10855179 02	EMP	.12091262 03	MEP	.48232200 02
MPS	.16455989 03	MSP	.16207647 00	SMP	.15277899 02	SEM	.70482319 02	EMS	.10937268 03	ESM	.14452625 00
EPT	.10855179 02	ETP	.12091262 03	TEP	.48232200 02	TPS	.16455989 03	TSP	.16207647 00	STP	.15277899 02
SET	.70482319 02	STE	.10937268 03	EST	.14452625 00	RPM	.15809929 07	RPT	.15809929 07	SPN	.15534859 03
GCE	.30458122 03	GCT	.32284920 03	SIP	.16449690 03	CPT	.74233626 02	SIN	.74170639 02	D1	.32979295-01
REP	.18186161 07	VEP	.10225239 01	CPE	.73078378 02	CPS	.93564416 02	D2	.31822977-01	D3	.13272513-03

370 DAYS 22 HRS. 15 MIN. 36.199 SEC. JULIAN DATE 2438327.50815047 OCT. 25,1963 00 11 44.200
RECTIFICATION .90643606-02 -.44326459 05 .14230191 05 .16745835 04

380 DAYS 12 HRS. 39 MIN. 36.200 SEC. JULIAN DATE 2438337.10815045 NOV. 3,1963 14 35 44.200
RECTIFICATION .25239923-01 -.57331553 05 -.19566645 05 -.13208364 05

389 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438346.50000000 NOV. 13,1963 00 00 00.000

GEOCENTRIC EQUATORIAL COORDINATES

X	-.29122640 07	Y	-.13168030 07	Z	.11371550 06	DX	-.11127057 01	DY	-.47243118-01	DZ	.17644411 00
R	.31981530 07	DEC	.20376725 01	RA	.20433047 03	V	.11275985 01	PTH	.67130975 02	AZ	.28857488 03
R	.31981531 07	LAT	.20376674 01	LON	.15294142 03	VE	.23348327 03	PTE	.25495815 00	AZE	.27003425 03
XS	-.95397739 08	YS	-.10387602 09	ZS	-.45044083 08	DXS	.23270138 02	DYS	-.17522492 02	DZS	-.75983748 01
XM	-.38943900 06	YM	-.10374900 06	ZM	-.59949999 04	DXM	.21168423 00	DYM	-.87470293 00	DZM	-.37896198 00
XT	-.38943900 06	YT	-.10374900 06	ZT	-.59949999 04	DXT	.21168423 00	DYT	-.87470293 00	DZT	-.37896198 00
RS	.14805379 09	VS	.30104357 02	RM	.40306640 06	VM	.97648737 00	RT	.40306640 06	VT	.97648737 00
GED	.20515418 01	ALT	.31917748 07	LOS	.17604716 03	RAS	.22743623 03	RAM	.19491748 03	LOM	.14352841 03
DUT	.34000000 02	DT	.86399999 05	DR	.10389644 01	SHA	-.16058012 07	DES	-.17712524 02	DEM	-.85221892 00

HELIOCENTRIC ECLIPTIC COORDINATES

X	.92485475 08	Y	.11205903 09	Z	.62783850 06	DX	-.24382844 02	DY	.19125885 02	DZ	.18065071 00
R	.14529688 09	LAT	.24758069 00	LON	.50466177 02	V	.30989598 02	PTH	-.14217252 01	AZ	.89659747 02
XE	.95397739 08	YE	.11322189 09	ZE	-.37000000 03	DXE	-.23270138 02	DYE	.19099032 02	DZE	-.23901462-04
XT	.95008300 08	YT	.11312432 09	ZT	.35406000 05	DXT	-.23058454 02	DYT	.18145765 02	DZT	.28949976-03
LTE	-.14318740-03	LOE	.49883404 02	LTT	.13732051-01	LOT	.49974528 02	RST	.14772843 09	VST	.29342138 02
EPS	.14922755 03	ESP	.63323127 00	SEP	.30139212 02	EPM	.14094492 01	EMP	.16874535 03	MEP	.98451746 01
MPS	.14993452 03	MSP	.54437597 00	SMP	.29521050 02	SEM	.36130193 02	EMS	.14377763 03	ESM	.91993210-01
EPT	.14094492 01	ETP	.16874535 03	TEP	.98451746 01	TPS	.14993452 03	TSP	.54437597 00	STP	.29521050 02
SET	.36130193 02	STE	.14377763 03	EST	.91993210-01	RPM	.28018701 07	RPT	.28018701 07	SPN	.14911328 03
GCE	.78508750 02	GCT	.76100218 02	SIP	.14989897 03	CPT	.76106849 02	SIN	.76071307 02	D1	.18609003-01
REP	.31981530 07	VEP	.11275985 01	CPE	.77232468 02	CPS	.98033109 02	D2	.16198032-01	D3	.20385000-04

409 DAYS 22 HRS. 3 MIN. 52.000 SEC. JULIAN DATE 2438366.50000000 DEC. 3,1963 00 00 00.000

CASE 1 SPACE TRAJECTCRIES 39

RA-5 POSTMIDCOURSE ORBIT

GEOCENTRIC EQUATCRIAL COORDINATES

X	-.48669050 07	Y	-.16927710 07	Z	.23C26950 06	DX	-.11175573 01	DY	-.42921603 00	DZ	-.5969867C-01
R	.51580288 07	DEC	.25587015 01	RA	.19917832 03	V	.11986345 C1	PTH	.84285168 02	AZ	.16130019 03
R	.51580291 07	LAT	.25587015 01	LON	.128C7617 C3	VE	.375718C5 C3	PTE	.18188111 00	AZE	.26998275 C3
XS	-.50213651 08	YS	-.12721123 09	ZS	-.55163302 08	DXS	.28482396 02	DYS	-.92C94716 C1	DZS	-.39922215 01
XM	-.51690999 05	YM	.33013500 06	ZM	.14110400 06	DXM	-.10755208 C1	DYM	-.13278019 C0	DZM	.49385935-01
XT	-.51690999 05	YT	.33013500 06	ZT	.14110400 06	DXT	-.10755208 C1	DYT	-.13278C19 00	DZT	.49385935-01
RS	.14746897 09	VS	.3C199322 02	RM	.36272774 C6	VM	.1C8481C8 C1	RT	.36272774 06	VT	.10848108 01
GED	.25761151 01	ALT	.51516506 07	LOS	.17735738 03	RAS	.24845953 03	RAM	.98898856 02	LOM	.27796715 02
DLT	.34000000 02	DT	.17280CCC 06	DR	.11926771 01	SHA	-.41733085 C7	DES	-.21966669 02	DEM	.22892789 02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.45346745 08	Y	.13719529 09	Z	.88477749 C6	DX	-.29599953 02	DY	.96200026 C1	DZ	.11477125 00
R	.14449795 09	LAT	.35083096 C0	LON	.71709883 02	V	.31124184 02	PTH	-.28462081 C0	AZ	.89786970 02
XE	.50213651 C8	YE	.13865673 09	ZE	.63500000 02	DXE	-.28482396 C2	DYE	.10C37539 02	DZE	-.12173951-02
XT	.50161959 C8	YT	.13901575 09	ZT	-.18210000 04	DXT	-.29557917 C2	DYT	.99353673 01	DZT	.96917271-01
LTE	.24671507-04	LOE	.70092465 02	LTT	-.70597666-03	LOT	.7C1587C1 C2	RST	.14778903 09	VST	.31183190 02
EPS	.12433788 03	ESP	.16550C43 01	SEP	.540C71C0 02	EPM	.39385607 C1	EMP	.77616230 02	MEP	.98445207 02
MPS	.12825309 03	MSP	.15904854 01	SMP	.50156400 02	SEM	.151898C0 C3	EMS	.28C35752 02	ESM	.66351990-01
EPT	.39385607 C1	ETP	.7761623C 02	TEP	.98445207 02	TPS	.128253C9 C3	TSP	.159C4854 01	STP	.50156400 02
SET	.15189800 03	STE	.28035752 02	EST	.66351990-01	RPM	.52236371 C7	RPT	.52236371 C7	SPN	.12426703 03
GCE	.85533795 02	GCT	.85002166 C2	SIP	.128234C3 03	CPT	.78998230 C2	SIN	.78979167 02	D1	.99815515-02
REP	.51580288 C7	VEP	.11986345 C1	CPE	.79874846 02	CPS	.10153520 03	D2	.63967554-02	D3	.27712752-05

HELIOCENTRIC CONIC ORBITAL B.T AND B.R ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2438371.63034301 DEC. 8,1963 03 07 41.637

SMA	.15286221 09	ECC	.5494215C-01	INC	.41033545 00	LAN	.12976893 C2	APF	.64205699 02	RCA	.14446364 09
VH	.27888523 02	C3	-.868203C2 03	C1	.44973255 10	SLR	.15240C78 C9	APO	.16126079 09	TFP	-.44326163 C6
TA	-.54720606 01	EA	-.51796500 01	MA	-.48954573 C1	DAI	.36954653 CC	RAI	.77182021 02	MTA	.18000C0C C3
WX	.16086257-02	WY	-.69805654-C2	WZ	.99997436 00	PX	.22184921 C0	PY	.97505667 C0	PZ	.64497399-02
CX	-.97507668 C0	QY	.22183314 C0	QZ	.31171340-02	RX	.14309036-02	RY	.62890109-02	RZ	-.99997628 00
SXI	.22184921 CC	SYI	.97505667 00	SZI	.64497399-C2	TX	.97507979 CC	TY	-.22185447 00	TZ	.00000000 00
BX	.97507951 00	BY	-.22183378 00	BZ	-.31171431-02	MX	-.94948022 C0	MY	.31380485 00	MZ	.37179889-02
B.T	.15263C13 09	B.R	.4757808C C6	B	.15263087 C9	PER	.37727291 03	DEF		C3J	

620613300503 221546012466 217434751367 6C1641713452 2C166424C727 200551775014
621001901 5608000 000000000000

APPENDIX D

Tables related to trajectory printout

Table D-1. *Ranger 5* trajectory key

	COLUMN / ROW	1	2	3	4	5	6	
GROUP A	1	GME	J	H	D	RE	REM	
	2	G	A	B	C	OME	AU	
	3	GMM	GMS	GMV	GMA	GMB	GMJ	
		INJECTION CONDITIONS	TARGET		JULIAN DATE	MONTH DAY, YEAR		hr min sec
GROUP B	4	GEOCENTRIC	XO YO		ZO DXO	DYO	DZO	
	5	CARTESIAN			TO GHA	GHO		
		TIME PAST INJECTION			JULIAN DATE	MONTH DAY, YEAR		hr min sec
		GEOCENTRIC					EQUATORIAL COORDINATES	
GROUP C	6	X	Y	Z	DX	DY	DZ	
	7	R	DEC	RA	V	PTH	AZ	
	8	R	LAT	LON	VE	PTE	AZE	
	9	XS	YS	ZS	DXS	DYS	DZS	
	10	XM	YM	ZM	DXM	DYM	DZM	
	11	XT	YT	ZT	DXT	DYT	DZT	
	12	RS	VS	RM	VM	RT	VT	
	13	GED	ALT	LOS	RAS	RAM	LOM	
	14	DUT	DT	DR	SHA	DES	DEM	
		GEOCENTRIC			CONIC ORBITAL	B • T AND B • R	EQUATORIAL COORDINATES	
		EPOCH OF PERICENTER PASSAGE			JULIAN DATE	MONTH DAY, YEAR		hr min sec
GROUP D	15	SMA	ECC	INC	LAN	APF	RCA	
	16	VH	C3	C1	SLR	APO	TFP	
	17	TA	EA	MA	DAO	RAO	MTA	
	18	WX	WY	WZ	PX	PY	PZ	
	19	QX	QY	QZ	RX	RY	RZ	
	20	SXO	SYO	SZO	TX	TY	TZ	
	21	BX	BY	BZ	MX	MY	MZ	
	22	B • T	B • R	B	PER	OMD	NOD	
	23	C3J						
		HELIOCENTRIC					EQUATORIAL COORDINATES	
GROUP E	24	X	Y	Z	DX	DY	DZ	
	25	R	LAT	LON	V	PTH	AZ	
	26	XE	YE	ZE	DXE	DYE	DZE	
	27	XT	YT	ZT	DXT	DYT	DZT	
	28	LTE	LOE	LTT	LOT	RST	VST	
	29	EPS	ESP	SEP	EPM	EMP	MEP	
	30	MPS	MSP	SMP	SEM	EMS	ESM	
	31	EPT	ETP	TEP	TPS	TSP	STP	
	32	SET	STE	EST	RPM	RPT	SPN	
	33	GCE	GCT	SIP	CPT	SIN	D1	
	34	REP	VEP	CPE	CPS	D2	D3	
		SELENOCENTRIC					EQUATORIAL COORDINATES	
GROUP F	35	X	Y	Z	DX	DY	DZ	
	36	R	DEC	RA	V	PTH	AZ	
	37	R	LAT	LON	VR	PTR	AZR	
	38	LTS	LNS	LTE	LNE			
	39	ALT	SHA	ALP	DR	DP	ASD	
	40	HGE	SVL	HNG	SIA			
		SELENOCENTRIC			CONIC ORBITAL	B • T AND B • R	EQUATORIAL COORDINATES	
		EPOCH OF PERICENTER PASSAGE			JULIAN DATE	MONTH DAY, YEAR		hr min sec
GROUP G	41	SMA	ECC	INC	LAN	APF	RCA	
	42	VH	C3	C1	SLR	APO	TFP	
	43	TA	EA	MA	DAI	RAI	MTA	
	44	WX	WY	WZ	PX	PY	PZ	
	45	QX	QY	QZ	RX	RY	RZ	
	46	SXO	SYO	SZO	DAO	RAO	TF	
	47	SXI	SYI	SZI	TX	TY	TZ	
	48	BX	BY	BZ	MX	MY	MZ	
	49	B • T	B • R	B	PER	DEF	C3J	
GROUP H	50	XOCTAL	YOCTAL ZOCTAL	$\dot{\text{X}}$OCTAL $\dot{\text{Y}}$OCTAL	$\dot{\text{Z}}$OCTAL			
	51		YY MM DDD HH	TT SS SSS	SOCTAL			

Table D-2. ***Ranger 5*** **trajectory key definitions**

Group		Trajectory constant
Group A		
Row 1	GME	Universal gravitational constant times the mass of Earth, km^3/sec^2
	J	Coefficient of the second harmonic in the Earth's potential function
	H	Coefficient of the third harmonic in the Earth's potential function
	D	Coefficient of the fourth harmonic in the Earth's potential function
	RE	Earth radius used in the potential function, km
	REM	Conversion factor for converting lunar ephemerides into km
Row 2	G	Universal constant of gravitation, $km^3/kg\ sec^2$
	A, B, C	Moments of inertia about principal axis for the Moon, $kg\ km^2$
	OME	Sidereal rotation rate of the Earth, deg/sec
	AU	Astronomical unit, km
Row 3	GMM	Universal gravitational constant times the mass of Moon, km^3/sec^2
	GMS	Universal gravitational constant times the mass of Sun, km^3/sec^2
	GMV	Universal gravitational constant times the mass of Venus, km^3/sec^2
	GMA	Universal gravitational constant times the mass of Mars, km^3/sec^2
	GMB	Universal gravitational constant times the mass of Earth–Moon, km^3/sec^2
	GMJ	Universal gravitational constant times the mass of Jupiter, km^3/sec^2
Group B		Injection conditions are vernal equinox cartesian coordinates in a geocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date.
Row 4	XO, YO, ZO	Cartesian components of the probe radius vector, km
	DXO, DYO, DZO	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 5	TO	Time of injection in seconds past midnight of day before launch, sec
	GHA	HA of Greenwich at injection epoch, deg
	GHO	HA of Greenwich at midnight of day before launch, deg
Group C		Inertial position and velocity of the probe, Sun, Moon and target body in a geocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.
Row 6	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 7	R	Probe radius distance, km
	DEC	Probe declination angle, deg
	RA	Probe right Ascension angle, deg
	V	Probe space-fixed velocity, km/sec
	PTH	Pitch angle of the probe space fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 8[a]	R	Probe radius distance, km
	LAT	Probe geocentric latitude, deg
	LON	Probe East longitude, deg
	VE	Probe Earth-fixed velocity, km/sec
	PTE	Pitch angle of the probe Earth-fixed velocity vector with respect to the local horizontal, deg
	AZE	Azimuth angle of the probe Earth-fixed velocity vector measured East of true North, deg
Row 9	XS, YS, ZS	Cartesian components of the Sun radius vector, km
	DXS, DYS, DZS	Cartesian components of the Sun space-fixed velocity vector, km/sec
Row 10	XM, YM, ZM	Cartesian components of the Moon radius vector, km
	DXM, DYM, DZM	Cartesian components of the Moon space-fixed velocity vector, km/sec
Row 11	XT, YT, ZT	Cartesian components of the target radius vector, km
	DXT, DYT, DZT	Cartesian components of the target space-fixed velocity vector, km/sec
Row 12	RS	Sun radius distance, km
	VS	Sun space-fixed velocity, km/sec
	RM	Moon radius distance, km
	VM	Moon space-fixed velocity, km/sec
	RT	Target radius distance, km
	VT	Target space-fixed velocity, km/sec

[a] These are Earth-fixed spherical coordinates in a geocentric equatorial system. The principal direction X is directed towards Greenwich and is the intersection of the meridian plane of Greenwich with the equatorial plane. The principal plane is the Earth's geometrical equatorial plane X, Y, Z is along the direction of the Earth's geometrical north direction.

Table D-2. (Cont'd)

Group		Trajectory constant
Row 13	GED	Geodetic latitude of the probe, deg
	ALT	Altitude of the probe above the Earth's surface, km
	LOS	East longitude of the Sun in coordinate system defined in Row 8, deg
	RAS	Right ascension of the Sun, deg
	RAM	Right ascension of the Moon, deg
	LOM	East longitude of the Moon in coordinate system defined in Row 8, deg
Row 14	DUT	Ephemeris time minus Universal Time, sec
	DT	Adams-Moulton step size, sec
	DR	Radial velocity of probe, km/sec
	SHA	Sun shadow parameter, km
	DES	Declination of the Sun, deg
	DEM	Declination of the Moon, deg
Group D		Characteristics of the Earth conic in the geocentric equatorial system described under Group B
Row 15	SMA	Semimajor axis, km
	ECC	Eccentricity
	INC	Inclination of the orbit plane to the equatorial plane, deg
	LAN	Longitude of the ascending node, deg
	APF	Argument of pericenter, deg
	RCA	Magnitude of the closest approach vector, km
Row 16	VH	Hyperbolic excess speed, km/sec
	C3	Twice the energy (*vis viva* energy integral, km^2/sec^2)
	C1	Angular momentum, km^2/sec
	SLR	Semi-latus rectum, km
	APO	Apogee distance, km
	TFP	Time from pericenter passage, sec
Row 17	TA	True anomaly, deg
	EA	Eccentric anomaly, deg
	MA	Mean anomaly, deg
	DAO	Declination of the outgoing asymptote,[b] deg
	RAO	Right ascension of the outgoing asymptote,[b] deg
	MTA	Maximum true anomaly, deg
Row 18	WX, WY, WZ	Components of a unit vector normal to the conic $\mathbf{W} = \dfrac{\mathbf{R} \times \mathbf{V}}{\lvert \mathbf{R} \times \mathbf{V} \rvert}$
	PX, PY, PZ	Components of a unit vector in the direction of perigee
Row 19	QX, QY, QZ	Components of a unit vector perpendicular to the perigee direction, vector **P**, and being in the orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX, RY, RZ	Components of the unit vector **R**[b]
Row 20	SXO, SYO, SZO	Components of the unit vector $\mathbf{S}_0$[b] along the direction of the outgoing asymptote
	TX, TY, TZ	Components of the unit vector **T**[b]
Row 21	BX, BY, BZ	Components of the impact parameter **B**,[b] km
	MX, MY, MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector **R**. $\mathbf{M} = \mathbf{W} \times \dfrac{\mathbf{R}}{\lvert \mathbf{R} \rvert}$
Row 22	B•T	Projection of the impact parameter **B**[b] upon the vector **T**, km
	B•R	Projection of the impact parameter **B**[b] upon the vector **R**, km
	B	The magnitude of the impact parameter,[b] km
	PER	Period, min
	OMD	Rate of change of argument of perigee, deg/day
	NOD	Rate of change of RA of the ascending node, deg/day
Row 23	C3J	Earth–Moon Jacobi constant, km^2/sec^2
Group E		Inertial position and velocity of the probe, Sun, Moon, and target body in a heliocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the equatorial plane of date. Z is along the direction of the Earth's spin axis of date. Miscellaneous parameters are also included.
Row 24	X, Y, Z	Cartesian components of the probe radius vector, km
	DX, DY, DZ	Cartesian components of the probe space-fixed velocity vector, km/sec
Row 25	R	Sun probe radius distance, km
	LAT	Probe celestial declination, deg
	LON	Probe celestial right ascension, deg
	V	Probe space-fixed velocity, km/sec
	PTH	Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg
	AZ	Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 26	XE, YE, ZE	Cartesian components of the Earth radius vector, km
	DXE, DYE, DZE	Cartesian components of the Earth-space-fixed velocity vector, km/sec
Row 27	XT, YT, ZT	Cartesian components of the target radius vector, km
	DXT, DYT, DZT	Cartesian components of the target space-fixed velocity vector, km/sec

[b] See appendix A.

Table D-2. (Cont'd)

Group		Trajectory constant
Row 28	LTE LOE LTT LOT RST VST	Celestial latitude of the Earth, deg Celestial longitude of the Earth, deg Celestial latitude of the target, deg Celestial longitude of the target, deg Sun–target range, km Sun–target velocity, km/sec
Row 29	EPS ESP SEP EPM EMP MEP	Earth–probe–Sun angle, deg Earth–Sun–probe angle, deg Sun–Earth–probe angle, deg Earth–probe–Moon angle, deg Earth–Moon–probe angle, deg Moon–Earth–probe angle, deg
Row 30	MPS MSP SMP SEM EMS ESM	Moon–probe–Sun angle, deg Moon–Sun–probe angle, deg Sun–Moon–probe angle, deg Sun–Earth–Moon angle, deg Earth–Moon–Sun angle, deg Earth–Sun–Moon angle, deg
Row 31	EPT ETP TEP TPS TSP STP	Earth-probe-target angle, deg Earth-target-probe angle, deg Target-Earth-probe angle, deg Target-probe-Sun angle, deg Target-Sun-probe angle, deg Sun-target-probe angle, deg
Row 32	SET STE EST RPM RPT SPN	Sun-Earth-target angle, deg Sun-target-Earth angle, deg Earth-Sun-target angle, deg Moon probe radius distance, km Target probe radius distance, km Sun-probe-near limb of Earth angle, deg
Row 33	GCE GCT SIP CPT SIN D1	Clock angle of Earth, deg Clock angle of target, deg Sun-probe-near limb of target angle, deg Canopus-probe-near limb of target angle, deg Canopus-probe-near limb of target angle, deg Radius of a circle (target) used in construction of visible planet, cm
Row 34	REP VEP CPE CPS D2 D3	Earth probe distance, km Velocity of the probe with respect to Earth, km/sec Canopus-probe-Earth angle, deg Canopus-probe-Sun angle, deg Semi-minor axis of ellipse used in construction of visible planet, cm Distance from intersecton of ellipse with circle to the diameter (of the circle) that is perpendicular to D1, in construction of visible planet, cm
Group F Row 35, 36		Inertial position of probe in a selenocentric equatorial system. The principal direction X is the vernal equinox direction of date and the principal plane XY is the geocentric equatorial plane of date. Z is along the direction of the Earth's spin axis of date.
Row 37, 38, 39		Selenocentric-fixed spherical coordinates of the probe, Sun and Earth in a selenocentric equatorial system. The principal direction X is in the direction of the mean Moon–Earth line. The principal plane XY is the mean selenocentric equatorial plane. Z is along the direction of the Moon's mean spin axis. Miscellaneous parameters are also included.
Row 35	X Y Z DX DY DZ	Cartesian components of the probe radius vector, km Cartesian components of the probe velocity vector, km/sec
Row 36	R DEC RA V PTH AZ	Probe radius distance, km Probe declination angle, deg Probe right ascension angle, deg Probe space-fixed velocity, km/sec Pitch angle of the probe space-fixed velocity vector with respect to the local horizontal, deg Azimuth angle of the probe space-fixed velocity vector measured East of true North, deg
Row 37	R LAT LON VR RTR AZR	Probe radius distance, km Probe selenocentric latitude, deg Probe selenocentric East longitude, deg Probe selenocentric-fixed velocity, km/sec Pitch angle of the probe selenocentric-fixed velocity vector with respect to the local horizontal, deg Azimuth angle of the probe selenocentric-fixed velocity vector measured East of the Moon's mean spin axis, deg
Row 38	LTS LNS LTE LNE	Selenocentric latitude of the Sun, deg Selenocentric longitude of the Sun, deg Selenocentric latitude of the Earth, deg Selenocentric longitude of the Earth, deg
Row 39	ALT SHA ALP DR DP ASD	Altitude of the probe above the Moon's surface, km Sun shadow parameter, km Illuminated crescent orientation viewing angle, deg First time derivative of the probe radius distance, km/sec First time derivative of the probe radius direction, deg/sec Angular semidiameter of Moon as seen from the probe, deg
Row 40	HGE SVL HNG SIA	Right ascension of Earth in probe coordinate system,[c] deg Declination of the Moon in probe coordinate system,[c] deg Right ascension of the Moon in probe coordinate system,[c] deg Earth–probe–Moon angle minus ASD, deg
Group G		Characteristics of the selenocentric conic in the geocentric equatorial system described under Group B except centered at the Moon.

[c] Same coordinate system as defined under B except centered at the probe.

Table D-2. (Cont'd)

Group		Trajectory constant
Row 41	SMA	Semimajor axis, km
	ECC	Eccentricity
	INC	Inclination of the orbit plane to the equatorial plane, deg
	LAN	Longitude of the ascending node, deg
	APF	Argument of pericenter, deg
	RCA	Magnitude of the closest approach vector, km
Row 42	VH	Hyperbolic excess speed, km/sec
	C3	Twice the energy (*vis viva* energy integral, km^2/sec^2)
	C1	Angular momentum, km^2/sec
	SLR	Semi-latus rectum, km
	APO	Apogee distance, km
	TFP	Time from pericenter passage, sec
Row 43	TA	True anomaly, deg
	EA	Eccentric anomaly, deg
	MA	Mean anomaly, deg
	DAI	Declination of the outgoing asymptote,[b] deg
	RAI	Right ascension of the incoming asymptote,[b] deg
	MTA	Maximum true anomaly, deg
Row 44	WX, WY, WZ	Components of a unit vector normal to the conic $\mathbf{W} = \frac{\mathbf{R} \times \mathbf{V}}{\lvert \mathbf{R} \times \mathbf{V} \rvert}$
	PX, PY, PZ	Components of a unit vector in the direction of perigee
Row 45	QX, QY, QZ	Components of a unit vector perpendicular to the perigee direction, vector **P**, and being in the orbit plane $\mathbf{Q} = \mathbf{W} \times \mathbf{P}$
	RX, RY, RZ	Components of the unit vector **R**[b]
Row 46	SXO, SYO, SZO	Components of the unit vector $\mathbf{S}_0$[b] along the direction of the outgoing asymptote
	DAO	Declination of the outgoing asymptote,[b] deg
	RAO	Right ascension of the outgoing asymptote,[b] deg
	TF	Time from injection to epoch of pericenter passage, hr
Row 47	SXI, SYI, SZI	Components of the unit vector $\mathbf{S}_I$[b] along the direction of the incoming asymptote
	TX, TY, TZ	Components of the unit vector **T**[b]
Row 48	BX, BY, BZ	Components of the impact parameter **B**,[b] km
	MX, MY, MZ	Components of a unit vector which lies in the orbit plane and is normal to the radius vector **R**. $\mathbf{M} = \mathbf{W} \times \frac{\mathbf{R}}{\lvert \mathbf{R} \rvert}$
Row 49	$\mathbf{B} \cdot \mathbf{T}$	Projection of the impact parameter **B**[b] upon the vector **T**, km
	$\mathbf{B} \cdot \mathbf{R}$	Projection of the impact parameter **B**[b] upon the vector **R**, km
	B	The magnitude of the impact parameter,[b] km
	PER	Period, min
	DFF	Angle between the incoming and outgoing asymptotes, deg
	C3J	Earth–Moon Jacobi constant, km^2/sec^2
Group H		Cartesian coordinates and epoch of injection conditions in the geocentric equatorial system described under Group B.
Row 50	XOCTAL, YOCTAL, ZOCTAL	Cartesian components of the probe radius vector at injection in octal representation, km
	$\dot{X}$OCTAL, $\dot{Y}$OCTAL, $\dot{Z}$OCTAL	Cartesian components of the probe space-fixed velocity vector at injection in octal representation, km/sec
Row 51		Epoch of injection
	YY	Years past 1900
	MM	Month
	DDD	Day of month
	HH	Hours
	TT	Min
	SSSSS	Msec
	SOCTAL	Sec in octal representation
		The time past midnight Greenwich Meridian Time on (DD), month (MM) and year (YY + 1900) at which the injection epoch occurs is the time determined by the sum of HH, TT, SSSSS, and SOCTAL.

[b] See appendix A.

Table D-3. *Ranger 5* trajectory constants and conversion factors

Constants	Conversion factors
GM_{Sun}	$1.32715445 \times 10^{11}$ km³/sec²
GM_{Venus}	3.247695×10^{5} km³/sec²
$GM_{\oplus}$ [a]	3.986032×10^{5} km³/sec²
$GM_{\oplus-☾}$	4.03503×10^{5} km³/sec²
$GM_{☾}$ [b]	4.900759×10^{3} km³/sec²
GM_{Mars}	4.297780×10^{4} km³/sec²
$GM_{Jupiter}$	1.267106×10^{8} km³/sec²
M_{Sun}/M_{Venus}	408645
M_{Sun}/M_{Earth}	332951.3
M_{Earth}/M_{Moon}	81.335
$M_{Sun}/M_{Earth\text{-}Moon}$	328908
M_{Sun}/M_{Mars}	3,088,000
$M_{Sun}/M_{Jupiter}$	1047.39
Equatorial radius of Earth	6378.3149 km
1 AU	1.495990×10^{8} km
Ellipticity of Earth	1/298.3
Conversion from feet to meters	0.3048
Atmospheric model	1959 ARDC
Sidereal rotation rate of Earth	4.1780742×10^{-3} deg/sec
Universal constant of gravitation	6.671×10^{-20} km³/kg sec²
Speed of light	2.997925×10^{5} km/sec
Mean Moon radius	1738.09 km

Constants	Conversion factors
Moon moments of inertia about principal axis	$A = 0.88746 \times 10^{29}$ kg km² $B = 0.88764 \times 10^{29}$ kg km² $C = 0.88801 \times 10^{29}$ kg km²
Lunar and solar ephemerides	The Moon and Sun positions are obtained from the joint JPL–STL ephemerides. For purposes of converting into kilometers, the conversion factors are: 1 AU = 1.495990×10^{8} km 1 e.r. = 6378.3149
Geometrical Earth model, used in locating tracking and launching facilities upon the Earth	Clarke spheroid of 1866 $a = 6378.2064$ km $b = 6356.5838$ km $e^2 = 0.006768657997291$

Earth potential function:

$$\Phi(R, \phi) = \frac{GM_{\oplus}}{R}\left[1 + \frac{JR_E^2}{3R^2}(1 - 3\sin^2\phi) + \frac{H}{5}\frac{R_E^3}{R^3}(3 - 5\sin^2\phi)(\sin\phi) + \frac{D}{35}\frac{R_E^4}{R^4}(3 - 30\sin^2\phi + 35\sin^4\phi)\right]$$

where

R = geocentric distance
ϕ = geocentric latitude
$J = 1.62345 \times 10^{-3}$
$H = -0.575 \times 10^{-5}$
$D = 0.7875 \times 10^{-5}$

[a] 3.9860005×10^{5} km³/sec² was used for the premidcourse orbit.

[b] 4.9007604×10^{3} km³/sec² was used for the premidcourse orbit.

APPENDIX E

Ranger 5 orbit determination program printout

```
PAGE HEADING                                                              (23
(RA-5 DATA  WITH PHYSICAL CONSTANTS  29 MAR 63)
EPOCH                                                                     (01
621001817,3723000
PROBE PCSITION AND VELOCITY AT EPOCH                                      (02
X=.58071750E4 Y=-.18721146E4 Z=-.28938554E4
DX=.36231603E1 DY=.97634882E1 DZ=-.28622333E1
OTHER PARAMETER VALUES                                                    (03
KE=.39860012E6
SOLAR PRESSURE OFF
ESTIMATE THESE PARAMETERS                                                 (04
X Y Z DX DY DZ KE KM
RI(4) LA(4) LO(4) RI(5) LA(5) LO(5)
COVARIANCE MATRIX OF ESTIMATED PARAMETERS                                 (10
R01=.22967767E4,-.10124447E4,-.16345165E4
 .11966233E2 ,-.86951903E1,-.13293133E2
R02=-.10124447E4 ,.48240222E3,.64817911E3
  -.50240319E1,.34354502E1,.50287229E1
R03=-.16345165E4,.64817911E3,.18941836E4
 -.85627807E1,.75456632E1,.13507922E2
R04=.11966233E2,-.50240319E1,-.85627807E1
  .648794584E-1 ,-.48061164E-1,-.73690140E-1
R05=-.86951903E+1,.34354502E1,.75456632E1
  -.48061164E-1,.382619394E-1,.62263512E-1
 R06=-.13293133E2,.50287229E1,.13507922E2,
  -.73690140E-1,.62263512E-1,.10635126
 R07=0,0,0,0,0,0,16.
R08=0,0,0,0,0,0,0,25.
  R09=0,0,0,0,0,0,0,0,.0036
 R10=0,0,0,0,0,0,0,0,0,1.E-6
 R11=0,0,0,0,0,0,0,0,0,0,1.E-6
R12=0,0,0,0,0,0,0,0,0,0,0,.0036
R13=0,0,0,0,0,0,0,0,0,0,0,0,1.E-6
R14=0,0,0,0,0,0,0,0,0,0,0,0,0,1.E-6
WEIGHTS BY DATA TYPE AND STATION                                          (16
HA(4)=-.1 DEC(4)=-.1
STATISTICS,PLOT AND/OR PRINT RESIDUALS FOR THESE PARAMETERS               (14
CC3(1)=.5 CC3(4)=.5 CC3(5)=.5 HA(5)=.5 DEC(5)=.5 HA(4)=.5 DEC(4)=.5
REJECTION SIGMAS                                                          (06
CC3(1)=1.0
CC3(4)=.5 CC3(5)=.5
HA(4)=.1 DEC(4)=.1
HA(5)=.1 DEC(5)=.1
NOMINAL VALUES CORRESPONDING TO COVARIANCE MATRIX                         (15
.57878923E4 -.18580354E4 -.28846691E4
.35637716E1 .97845945E1 -.28486888E1
DELETE THESE DATA TYPES                                                   (13
AZ(1) EL(1)
 CC3(1)
OFFLINE CONTROL                                                           (27
KEY(14) KEY(16)
END DATA                                                                  (00
```

INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 2

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.54118917 02	-.72830780 02	.88354531 02	-.29061026 05	-.14223054 05	-.12823207 05	.00000000 00	.00000000 00	.00000000 00
Y	-.72830780 02	.26098586 03	-.25506021 03	.55915933 05	-.67048375 04	.53621163 05	-.00000000 00	-.00000000 00	-.00000000 00
Z	.88354531 02	-.25506021 03	.25803798 03	-.61470469 05	-.15768433 04	-.51339392 05	.00000000 00	.00000000 00	.00000000 00
DX	-.29061026 05	.55915933 05	-.61470469 05	.17347512 08	.49997007 07	.10624060 08	-.00000000 00	-.00000000 00	-.00000000 00
DY	-.14223054 05	-.67048375 04	-.15768433 04	.49997007 07	.79223018 07	-.24343293 07	.00000000 00	.00000000 00	.00000000 00
DZ	-.12823207 05	.53621163 05	-.51339392 05	.10624060 08	-.24343293 07	.11169038 08	-.00000000 00	-.00000000 00	-.00000000 00
KE	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.62500000-01	.00000000 00	.00000000 00
KM	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.39999999-01	.00000000 00
RI04	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.27777777 03
LA04	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO04	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI05	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA05	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO05	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00

	LA04	LO04	RI05	LA05	LO05
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI04	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA04	.10000000 07	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO04	.00000000 00	.10000000 07	.00000000 00	.00000000 00	.00000000 00
RI05	.00000000 00	.00000000 00	.27777777 03	.00000000 00	.00000000 00
LA05	.00000000 00	.00000000 00	.00000000 00	.10000000 07	.00000000 00
LO05	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 07

CASE 1 SPACE TRAJECTORIES 1

EPHEMERIDES WITH VENUS VELOCITIES

GME	.39860005 06	J	.16234500-02	H	-.57499999-05	D	.78749999-05	RE	.63781650 04	REM	.63783149 04
G	.66709998-19	A	.88745998 29	B	.88763998 29	C	.88800998 29	OME	.41780741-02	AU	.14959900 09
GMM	.49007604 04	GMS	.13271544 12	GMV	.32476952 06	GMA	.42977799 05	GMB	.37918700 08	GMJ	.12671062 09
ARA	.27890000 01	GB	.00000000 00	MAS	.34020000 03	GB1	.00000000 00	GB2	.00000000 00	SC	.00000000 00

INJECTION CONDITIONS MOON JULIAN DATE 2437956.23429397 OCT. 18,1962 17 37 23.000

GEOCENTRIC XO .58072045 04 YO-.18712691 04 ZO-.28917841 04 DXO .36254799 01 DYO .97646341 01 DZO-.28587345 01
CARTESIAN GMC .00000000 00 SGC .00000000 00 TO .63443000 05 GHA .29107121 03 GHO .26001651 02

0 DAYS 0 HRS. 0 MIN. 0.000 SEC. JULIAN DATE 2437956.23429397 OCT. 18,1962 17 37 23.000

GEOCENTRIC EQUATORIAL COORDINATES

X	.58072042 04	Y	-.18712691 04	Z	-.28917840 04	DX	.36254799 01	DY	.97646336 01	DZ	-.28587344 01
R	.67518652 04	DEC	-.25359349 02	RA	.34213937 03	V	.10801136 02	PTH	.87138041 01	AZ	.10292465 03
R	.67518651 04	LAT	-.25359349 02	LON	.51068167 02	VE	.10373188 02	PTE	.90762695 01	AZE	.10348129 03
XS	-.13520355 09	YS	-.57485767 08	ZS	-.24927463 08	DXS	.12999477 02	DYS	-.24699600 02	DZS	-.10709378 02
XM	-.35387369 05	YM	.35420195 06	ZM	.13533407 06	DXM	-.10263042 01	DYM	-.47486982-01	DZM	.61074528-01
XT	-.35387369 05	YT	.35420195 06	ZT	.13533407 06	DXT	-.10263042 01	DYT	-.47486982-01	DZT	.61074528-01
RS	.14901675 09	VS	.29895608 02	RM	.38082357 06	VM	.10292159 01	RT	.38082357 06	VT	.10292159 01
GED	-.25510276 02	ALT	.37761981 03	LOS	.27196299 03	RAS	.20303420 03	RAM	.95705333 02	LOM	.16463412 03
DUT	.49007604 04	DT	.37500000 01	DR	.16363608 01	SHA	.53923416 04	DES	-.96296881 01	DEM	.20816250 02

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437956.23211020 OCT. 18,1962 17 34 14.322

SMA	.28338684 06	ECC	.97672775 00	INC	.28267547 02	LAN	.10032215 03	APF	.22709996 03	RCA	.65950499 04
VH	.12868401 00	C3	-.14065581 01	C1	.72086038 05	SLR	.13036618 05	APO	.56017862 06	TFP	.18867780 03
TA	.17636902 02	EA	.19287501 01	MA	.45242081-01	DAO	-.20299310 02	RAO	.32378684 03	MTA	.18000000 03
WX	.46592479 00	WY	.84859005-01	WZ	.88074573 00	PX	.75671530 00	PY	-.55409869 00	PZ	-.34692437 00
QX	.45858040 00	QY	.82811441 00	QZ	-.32238242 00	RX	-.74409102-01	RY	.45422293 00	RZ	-.88777515 00
SXO	.75671530 00	SYO	-.55409869 00	SZO	-.34692437 00	TX	-.64949612 00	TY	-.69760744 00	TZ	-.30248748 00
BX	-.45858043 00	BY	-.82811446 00	BZ	.32238244 00	MX	.20775271 00	MY	.95707244 00	MZ	-.20211662 00
B.T	.47289826 05	B.R	-.38184787 05	B	.60781623 05	PER	.25022428 05	OMD	.11568763-01	NOD	-.70793174-02

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13520936 09	Y	.62654867 08	Z	-.16775000 04	DX	-.93739967 01	DY	.34742733 02	DZ	-.65083363 01
R	.14902081 09	LAT	-.64496807-03	LON	.24862606 02	V	.36568945 02	PTH	.96058464 01	AZ	.10039908 03
XE	.13520355 09	YE	.62657735 08	ZE	.23125000 03	DXE	-.12999477 02	DYE	.26921386 02	DZE	-.88334083-03
XT	.13516816 09	YT	.63036539 08	ZT	-.16518000 05	DXT	-.14025781 02	DYT	.26902116 02	DZT	.74041843-01
LTE	.88913821-04	LOE	.24864544 02	LTT	-.63456084-02	LOT	.25002294 02	RST	.14914435 09	VST	.30338949 02
EPS	.52998805 02	ESP	.27453512-18	SEP	.12699912 03	EPM	.59788080 02	EMP	.87779073 00	MEP	.11933403 03
MPS	.10868797 03	MSP	.13970734 00	SMP	.71172218 02	SEM	.10950789 03	EMS	.70354204 02	ESM	.13776809 00
EPT	.59788080 02	ETP	.87779073 00	TEP	.11933403 03	TPS	.10868797 03	TSP	.13970734 00	STP	.71172218 02
SET	.10950789 03	STE	.70354204 02	EST	.13776809 00	RPM	.38417640 06	RPT	.38417640 06	SPN	-.17845056 02
SAC	.00000000 00										
GCE	.26321723 03	GCT	.28628363 03	SIP	.10842877 03	CPT	.73767243 02	SIN	.73508037 02		
REP	.67518652 04	VEP	.10801136 02								

```
CASE  1                                   SPACE TRAJECTORIES                                                   2

HELIOCENTRIC                                          CONIC        ORBITAL B.T AND B.R         ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE                        JULIAN DATE 2437933.91683991              SEPT. 26,1962    10 00 14.969
   SMA  .29899029 09    ECC  .52194709 00    INC  .10399078 02    LAN  .20485908 03    APF  .15175261 03    RCA  .14293318 09
    VH  .11807838 02     C3 -.44387875 03     C1  .53731260 10    SLR  .21753674 09    APO  .45504740 09    TFP  .19282280 07
    TA  .28250959 02     EA  .16056169 02     MA  .77849549 01    DAI  .49006684 01    RAI  .35700551 03    MTA  .18000000 03
    WX -.75881461-01     WY  .16377871 00     WZ  .98357438 00     PX  .99498380 00     PY -.52048865-01     PZ  .85428537-01
    QX  .65185304-01     QY  .98512302 00     QZ -.15900762 00     RX  .85310558-01     RY -.44882108-02     RZ -.99634424 00
   SXI  .99498380 00    SYI -.52048865-01    SZI  .85428537-01     TX -.52242015-01     TY -.99863446 00     TZ  .25379255-04
    BX -.65185308-01     BY -.98512307 00     BZ  .15900763 00     MX -.41353952 00     MY  .89241447 00     MZ -.18050336 00
   B.T  .25176443 09    B.R -.40694422 08      B  .25503208 09    PER  .10320270 04    DEF

SELENOCENTRIC                                                                             EQUATORIAL COORDINATES

     X  .41194573 05      Y -.35607321 06      Z -.13822585 06     DX  .46517840 01     DY  .98121205 01     DZ -.29198089 01
     R  .38417640 06    DEC -.21087783 02     RA  .27659928 03      V  .11244647 02    PTH -.42143222 02     AZ  .13641073 03
     R  .38417638 06    LAT  .29094274 01    LON  .88834020 01     VR  .10798765 02    PTR -.44322086 02    AZR  .14623822 03
   LTS  .15087128 01    LNS  .29766215 03    LTE  .32355818 01    LNE  .80671756 01
   ALT  .38243840 06    SHA -.36362023 06    ALP  .74857154 00     DR -.75450024 01     DP  .12434585-02    ASD  .25920568 00
   HGE  .30700120 03    SVL -.21786000 02    HNG  .24981456 03    SIA  .59528874 02
   SAC  .00000000 00

  0 DAYS  7 HRS. 25 MIN. 28.000 SEC.               JULIAN DATE 2437956.54364584              OCT. 19,1962    01 02 51.000

GEOCENTRIC                                                                                EQUATORIAL COORDINATES

     X -.45556816 05      Y  .85915007 05      Z  .15889843 05     DX -.16959239 01     DY  .18049031 01     DZ  .72503368 00
     R  .98535774 05    DEC  .92800182 01     RA  .11793497 03      V  .25806020 01    PTH  .73531435 02     AZ  .63162091 02
     R  .98535773 05    LAT  .92800182 01    LON  .75192142 02     VE  .69056517 01    PTE  .20999730 02    AZE  .27293657 03
    XS -.13485415 09     YS -.58145155 08     ZS -.25213363 08    DXS  .13144366 02    DYS -.24638440 02    DZS -.10682816 02
    XM -.62697718 05     YM  .35201148 06     ZM  .13661274 06    DXM -.10164129 01    DYM -.11617962 00    DZM  .34629923-01
    XT -.62697718 05     YT  .35201148 06     ZT  .13661274 06    DXT -.10164129 01    DYT -.11617962 00    DZT  .34629923-01
    RS  .14900408 09     VS  .29898990 02     RM  .38276118 06     VM  .10236172 01     RT  .38276118 06     VT  .10236172 01
   GED  .93421482 01    ALT  .92158128 05    LOS  .16058145 03    RAS  .20332429 03    RAM  .10009920 03    LOM  .57356369 02
   DUT  .49007604 04     DT  .24000000 03     DR  .24747339 01    SHA -.98408039 05    DES -.97420395 01    DEM  .20910780 02

GEOCENTRIC                                            CONIC        ORBITAL B.T AND B.R         EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE                        JULIAN DATE 2437956.23211952               OCT. 18,1962    17 34 15.126
   SMA  .27855490 06    ECC  .97631913 00    INC  .28284067 02    LAN  .10025707 03    APF  .22718085 03    RCA  .65964223 04
    VH  .13094338 00     C3 -.14309569 01     C1  .72086085 05    SLR  .13036636 05    APO  .55051336 06    TFP  .26915873 05
    TA  .15271566 03     EA  .48552303 02     MA  .66226772 01    DAO -.20338486 02    RAO  .32379834 03    MTA  .18000000 03
    WX  .46627092 00     WY  .84374990-01     WZ  .88060915 00     PX  .75663491 00     PY -.55380667 00     PZ -.34756557 00
    QX  .45836140 00     QY  .82835928 00     QZ -.32206502 00     RX -.74942350-01     RY  .45461764 00     RZ -.88752829 00
   SXO  .75663491 00    SYO -.55380667 00    SZO -.34756557 00     TX -.64952850 00     TY -.69758225 00     TZ -.30247600 00
    BX -.45836137 00     BY -.82835922 00     BZ  .32206500 00     MX -.75421171 00     MY -.48232960 00     MZ  .44555924 00
   B.T  .46892333 05    B.R -.37848762 05      B  .60261261 05    PER  .24385189 05    OMD  .11866089-01    NOD -.72631700-02
```

CASE 1 SPACE TRAJECTORIES 3

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13480859 09	Y	.63461581 08	Z	-.19394000 05	DX	-.14840290 02	DY	.28799071 02	DZ	-.53780793-01
R	.14899909 09	LAT	-.74577254-02	LON	.25208862 02	V	.32397895 02	PTH	-.20533743 01	AZ	.90095440 02
XE	.13485415 09	YE	.63376436 08	ZE	.20750000 03	DXE	-.13144366 02	DYE	.26854706 02	DZE	-.92089175-03
XT	.13479145 09	YT	.63753740 08	ZT	-.14497500 05	DXT	-.14160779 02	DYT	.26761893 02	DZT	.77070593-01
LTE	.79788917-04	LOE	.25171779 02	LTT	-.55707544-02	LOT	.25313240 02	RST	.14910827 09	VST	.30277591 02
EPS	.92879859 02	ESP	.38308338-01	SEP	.87082296 02	EPM	.15240507 03	EMP	.68486949 01	MEP	.20746221 02
MPS	.11184784 03	MSP	.10444440 00	SMP	.68047762 02	SEM	.10572508 03	EMS	.74133345 02	ESM	.14179264 00
EPT	.15240507 03	ETP	.68486949 01	TEP	.20746221 02	TPS	.11184784 03	TSP	.10444440 00	STP	.68047762 02
SET	.10572508 03	STE	.74133345 02	EST	.14179264 00	RPM	.29270319 06	RPT	.29270319 06	SPN	.89168638 02
SAC	.00000000 00										
GCE	.11542093 03	GCT	.28289590 03	SIP	.11150763 03	CPT	.77055983 02	SIN	.76715773 02		
REP	.98535774 05	VEP	.25806020 01								

HELIOCENTRIC CONIC ORBITAL B.T AND B.R ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437968.94619231 OCT. 31,1962 10 42 31.016

SMA	.18135415 09	ECC	.18185834 00	INC	.95130239-01	LAN	.20074083 03	APF	.19788441 03	RCA	.14837339 09
VH	.22507565 02	C3	-.73180260 03	C1	.48241571 10	SLR	.17535632 09	APO	.21433491 09	TFP	-.10715800 07
TA	-.13416383 02	EA	-.11178339 02	MA	-.91583388 01	DAI	-.29399695-01	RAI	.38625224 02	MTA	.18000000 03
WX	-.59170647-03	WY	.15625373-02	WZ	.99999862 00	PX	.78124532 00	PY	.62422322 00	PZ	-.51310489-03
QX	-.62422316 00	QY	.78124393 00	QZ	-.15900818-02	RX	-.38197126-03	RY	-.34393359-03	RZ	-.99999944 00
SXI	.78124532 00	SYI	.62422322 00	SZI	-.51310489-03	TX	.62422358 00	TY	-.78124575 00	TZ	.30261203-04
BX	.62422343 00	BY	-.78124426 00	BZ	.15900825-02	MX	-.42591886 00	MY	.90475984 00	MZ	-.16657422-02
B.T	.17832973 09	B.R	-.27816277 06	B	.17832994 09	PER	.48752473 03	DEF			

SELENOCENTRIC EQUATORIAL COORDINATES

X	.17140902 05	Y	-.26609648 06	Z	-.12072290 06	DX	-.67951095 00	DY	.19210828 01	DZ	.69040375 00
R	.29270319 06	DEC	-.24358288 02	RA	.27368568 03	V	.21514998 01	PTH	-.74277270 02	AZ	.25204116 03
R	.29270315 06	LAT	-.19733697 00	LON	.19310836 01	VR	.24729806 01	PTR	-.56871898 02	AZR	.26351560 03
LTS	.15113509 01	LNS	.29389710 03	LTE	.28183512 01	LNE	.80824179 01				
ALT	.29096519 06	SHA	-.27148098 06	ALP	.39241978 00	DR	-.20710000 01	DP	.11412411-03	ASD	.34021087 00
HGE	.26712013 03	SVL	-.11612395 02	HNG	.11232868 03	SIA	.15206486 03				
SAC	.00000000 00										

J MATRIX ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.13458271 07	-.42695344 06	-.69104582 06	.67030651 09	.17484865 10	-.51716629 09	-.24677413 05	.20356955 02	.88889120 04
Y	-.42695344 06	.13584474 06	.21903042 06	-.21254745 09	-.55497506 09	.16411358 09	.78256343 04	-.64316997 01	-.28108114 04
Z	-.69104582 06	.21903042 06	.35523799 06	-.34433515 09	-.89809155 09	.26555853 09	.12671252 05	-.10410846 02	-.45778470 04
DX	.67030651 09	-.21254745 09	-.34433515 09	.33394781 12	.87091327 12	-.25760137 12	-.12290704 08	.10103704 05	.44512218 07
DY	.17484865 10	-.55497506 09	-.89809155 09	.87091327 12	.22724525 13	-.67197388 12	-.32057156 08	.26367153 05	.11568369 08
DZ	-.51716629 09	.16411358 09	.26555853 09	-.25760137 12	-.67197388 12	.19875959 12	.94819376 07	-.77950870 04	-.34385678 07
KE	-.24677413 05	.78256343 04	.12671252 05	-.12290704 08	-.32057156 08	.94819376 07	.45269174 03	-.37599758 00	-.16215966 03
KM	.20356955 02	-.64316997 01	-.10410846 02	.10103704 05	.26367153 05	-.77950870 04	-.37599758 00	.40375378-01	.10492516 00
RI04	.88889120 04	-.28108114 04	-.45778470 04	.44512218 07	.11568369 08	-.34385678 07	-.16215966 03	.10492516 00	.38400114 03
LA04	.14583833 06	-.38608051 05	-.71875618 05	.73458200 08	.17522160 09	-.55514334 08	-.27989832 04	.38691045 01	.26620280 04
LO04	.21731702 07	-.67999742 06	-.11193366 07	.10911930 10	.28117092 10	-.83890432 09	-.39536740 05	.23097192 02	.21163676 05
RI05	-.10909485 05	.34784936 04	.55564518 04	-.53688231 07	-.14142491 08	.41474010 07	.20310117 03	-.25137313 00	-.00000000 00
LA05	-.67996711 06	.21681498 06	.34632125 06	-.33462260 09	-.88148099 09	.25849706 09	.12658791 05	-.15662048 02	-.00000000 00
LO05	.74153486 06	-.23608852 06	-.37784806 06	.36525572 09	.96099065 09	-.28200611 09	-.13811942 05	.17397516 02	.00000000 00

	LA04	LO04	RI05	LA05	LO05
X	.14583833 06	.21731702 07	-.10909485 05	-.67996711 06	.74153486 06
Y	-.38608051 05	-.67999742 06	.34784936 04	.21681498 06	-.23608852 06
Z	-.71875618 05	-.11193366 07	.55564518 04	.34632125 06	-.37784806 06
DX	.73458200 08	.10911930 10	-.53688231 07	-.33462260 09	.36525572 09
DY	.17522160 09	.28117092 10	-.14142491 08	-.88148099 09	.96099065 09
DZ	-.55514334 08	-.83890432 09	.41474010 07	.25849706 09	-.28200611 09
KE	-.27989832 04	-.39536740 05	.20310117 03	.12658791 05	-.13811942 05
KM	.38691045 01	.23097192 02	-.25137313 00	-.15662048 02	.17397516 02
RI04	.26620280 04	.21163676 05	.00000000 00	.00000000 00	.00000000 00
LA04	.14397314 07	.58142246 06	.00000000 00	.00000000 00	.00000000 00
LO04	.58142246 06	.69952251 07	.00000000 00	.00000000 00	.00000000 00
RI05	-.00000000 00	-.00000000 00	.52221388 03	.15240347 05	-.16328309 05
LA05	-.00000000 00	-.00000000 00	.15240347 05	.19502564 07	-.10170301 07
LO05	.00000000 00	.00000000 00	-.16328309 05	-.10170301 07	.21490256 07

RA-5 DATA WITH PHYSICAL CONSTANTS 29 MAR 63

ITERATION NUMBER 3 EPOCH 62/10/18 173723.000 CLOCK 184340 SOS .69809 01 QSOS .78186 01

Q	DQ	STDEVDQ	OLD Q	NEW Q	NOMINAL Q	DQ (NOM)
X	.98345409-04	.12150873 00	.58072045 04	.58072046 04	.57878923 04	.19312378 02
Y	-.51871966-03	.61548643 00	-.18712691 04	-.18712696 04	-.18580354 04	-.13234238 02
Z	-.82820752-03	.11875530 01	-.28917841 04	-.28917849 04	-.28846691 04	-.71158752 01
DX	-.58494378-06	.12174419-02	.36254799 01	.36254794 01	.35637715 01	.61707824-01
DY	-.49989661-06	.68093622-03	.97646341 01	.97646336 01	.97845944 01	-.19960761-01
DZ	-.74291176-06	.18081599-02	-.28587345 01	-.28587352 01	-.28486888 01	-.10046452-01
KE	.10092480-02	.38332085 01	.39860005 06	.39860005 06	.39860012 06	-.66406250-01
KM	-.93224259-05	.49997383 01	.49007604 04	.49007604 04	.49007589 04	.14038086-02
STA 4						
RI	.38381816-04	.59906809-01	.63726097 04	.63726097 04	.63726076 04	.20141602-02
LA	.11962480-06	.99100249-03	-.31212329 02	-.31212329 02	-.31212360 02	.30517578-04
LO	.10190757-05	.97973610-03	.13688621 03	.13688621 03	.13688617 03	.38146973-04
STA 5						
RI	-.27632297-05	.59837643-01	.63754971 04	.63754971 04	.63754947 04	.23803711-02
LA	-.22363757-06	.99706403-03	-.25734780 02	-.25734780 02	-.25734820 02	.39339066-04
LO	-.21766378-06	.97883745-03	.27684755 02	.27684755 02	.27684780 02	-.25272369-04

J INVERSE ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.14764372-01	.12133066-01	.32046576-01	.34204017-04	.18074241-04	.81292810-04	.20391675 00	-.27649536-02	.11288408-02
Y	.12133066-01	.37882355 00	.69408379 00	.62127899-03	.40216185-03	.88521368-03	.15001394 01	-.39016967-01	-.11485511-02
Z	.32046576-01	.69408379 00	.14102823 01	.13862572-02	.80495197-03	.20125665-02	.27768874 01	-.74956287-01	.31840237-02
DX	.34204017-04	.62127899-03	.13862572-02	.14821648-05	.77838174-06	.21499007-05	.26652212-02	-.67547600-04	.77406520-05
DY	.18074241-04	.40216185-03	.80495197-03	.77838174-06	.46367414-06	.11422535-05	.15577744-02	-.41946636-04	.14039659-05
DZ	.81292810-04	.88521368-03	.20125665-02	.21499007-05	.11422535-05	.32694424-05	.36012987-02	-.10523597-03	.14375357-04
KE	.20391675 00	.15001394 01	.27768874 01	.26652212-02	.15577744-02	.36012987-02	.14693488 02	.43016005-01	.20345894-02
KM	-.27649536-02	-.39016967-01	-.74956287-01	-.67547600-04	-.41946636-04	-.10523597-03	.43016005-01	.24997383 02	-.37514658-04
RI04	.11288408-02	-.11485511-02	.31840237-02	.77406520-05	.14039659-05	.14375357-04	.20345894-02	-.37514658-04	.35888258-02
LA04	.64921410-05	-.95787267-04	-.10712261-03	-.45808345-07	-.49489806-07	.71638385-08	.11604473-03	-.18836405-05	-.38697642-06
LO04	.17821332-04	.20711727-03	.44092967-03	.38797852-06	.27904520-06	.74407486-06	-.15673334-03	.96496817-05	-.94684862-09
RI05	.14240673-02	.46162228-02	.13476359-01	.15716320-04	.76274993-05	.28133621-04	-.34468520-02	.52224820-04	.24265958-05
LA05	.24765557-04	.79823242-04	.23336013-03	.27221903-06	.13211916-06	.48779286-06	-.60260862-04	.78062734-06	.55369127-07
LO05	-.22069476-04	-.88286459-04	-.25443635-03	-.30110952-06	-.14157366-06	-.51455739-06	.54655159-04	-.79384651-05	.21584615-06

	LA04	LC04	RI05	LA05	LO05
X	.64921410-05	.17821332-04	.14240673-02	.24765557-04	-.22069476-04
Y	-.95787267-04	.20711727-03	.46162228-02	.79823242-04	-.88286459-04
Z	-.10712261-03	.44092967-03	.13476359-01	.23336013-03	-.25443635-03
DX	-.45808345-07	.38797852-06	.15716320-04	.27221903-06	-.30110952-06
DY	-.49489806-07	.27904520-06	.76274993-05	.13211916-06	-.14157366-06
DZ	.71638385-08	.74407486-06	.28133621-04	.48779286-06	-.51455739-06
KE	.11604473-03	-.15673334-03	-.34468520-02	-.60260862-04	.54655159-04
KM	-.18836405-05	.96496817-05	.52224820-04	.78062734-06	-.79384651-05
RI04	-.38697642-06	-.94684862-09	.24265958-05	.55369127-07	.21584615-06
LA04	.98208596-06	.31229541-08	.35150149-06	.65444070-08	.10230792-07
LO04	.31229541-08	.95988285-06	-.30097933-06	-.45436834-08	.35015982-07
RI05	.35150149-06	-.30097933-06	.35805436-02	-.33679265-06	-.96466709-07
LA05	.65444070-08	-.45436834-08	-.33679265-06	.99413668-06	-.25765525-08
LO05	.10230792-07	.35015982-07	-.96466709-07	-.25765525-08	.95812277-06

CCVARIANCE MATRIX OF ESTIMATED PARAMETERS   ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.14764372-01	.12133066-01	.32046576-01	.34204017-04	.18074241-04	.81292810-04	.20391675 00	-.27649536-02	.11288408-02
Y	.12133066-01	.37882355 00	.69408379 00	.62127899-03	.40216185-03	.88521368-03	.15001394 01	-.39016967-01	-.11485511-02
Z	.32046576-01	.69408379 00	.14102823 01	.13862572-02	.80495197-03	.20125665-02	.27768874 01	-.74956287-01	.31840237-02
DX	.34204017-04	.62127899-03	.13862572-02	.14821648-05	.77838174-06	.21499007-05	.26652212-02	-.67547600-04	.77406520-05
DY	.18074241-04	.40216185-03	.80495197-03	.77838174-06	.46367414-06	.11422535-05	.15577744-02	-.41946636-04	.14039659-05
DZ	.81292810-04	.88521368-03	.20125665-02	.21499007-05	.11422535-05	.32694424-05	.36012987-02	-.10523597-03	.14375357-04
KE	.20391675 00	.15001394 01	.27768874 01	.26652212-02	.15577744-02	.36012987-02	.14693488 02	.43016005-01	.20345894-02
KM	-.27649536-02	-.39016967-01	-.74956287-01	-.67547600-04	-.41946636-04	-.10523597-03	.43016005-01	.24997383 02	-.37514658-04
RI04	.11288408-02	-.11485511-02	.31840237-02	.77406520-05	.14039659-05	.14375357-04	.20345894-02	-.37514658-04	.35888258-02
LA04	.64921410-05	-.95787267-04	-.10712261-03	-.45808345-07	-.49489806-07	.71638385-08	.11604473-03	-.18836405-05	-.38697642-06
LOC4	.17821332-04	.20711727-03	.44092967-03	.38797852-06	.27904520-06	.74407486-06	-.15673334-03	.96496817-05	-.94684862-09
RI05	.14240673-02	.46162228-02	.13476359-01	.15716320-04	.76274993-05	.28133621-04	-.34468520-02	.52224820-04	.24265958-05
LA05	.24765557-04	.79823242-04	.23336013-03	.27221903-06	.13211916-06	.48779286-06	-.60260862-04	.78062734-06	.55369127-07
LO05	-.22069476-04	-.88286459-04	-.25443635-03	-.30110952-06	-.14157366-06	-.51455739-06	.54655159-04	-.79384651-05	.21584615-06

	LA04	LOC4	RI05	LA05	LO05
X	.64921410-05	.17821332-04	.14240673-02	.24765557-04	-.22069476-04
Y	-.95787267-04	.20711727-03	.46162228-02	.79823242-04	-.88286459-04
Z	-.10712261-03	.44092967-03	.13476359-01	.23336013-03	-.25443635-03
DX	-.45808345-07	.38797852-06	.15716320-04	.27221903-06	-.30110952-06
DY	-.49489806-07	.27904520-06	.76274993-05	.13211916-06	-.14157366-06
DZ	.71638385-08	.74407486-06	.28133621-04	.48779286-06	-.51455739-06
KE	.11604473-03	-.15673334-03	-.34468520-02	-.60260862-04	.54655159-04
KM	-.18836405-05	.96496817-05	.52224820-04	.78062734-06	-.79384651-05
RI04	-.38697642-06	-.94684862-09	.24265958-05	.55369127-07	.21584615-06
LA04	.98208596-06	.31229541-08	.35150149-06	.65444070-08	.10230792-07
LO04	.31229541-08	.95988285-06	-.30097933-06	-.45436834-08	.35015982-07
RI05	.35150149-06	-.30097933-06	.35805436-02	-.33679265-06	-.96466709-07
LA05	.65444070-08	-.45436834-08	-.33679265-06	.99413668-06	-.25765525-08
LO05	.10230792-07	.35015982-07	-.96466709-07	-.25765525-08	.95812277-06

CORRELATION MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.10000000 01	.16223501 00	.22208597 00	.23121786 00	.21844703 00	.37000518 00	.43780725 00	-.45512751-02	.15507759 00
Y	.16223501 00	.10000000 01	.94959932 00	.82912485 00	.95956843 00	.79541320 00	.63584415 00	-.12679080-01	-.31149828-01
Z	.22208597 00	.94959932 00	.10000000 01	.95883207 00	.99542952 00	.93726063 00	.61001821 00	-.12624314-01	.44755569-01
DX	.23121786 00	.82912485 00	.95883207 00	.10000000 01	.93894023 00	.97663732 00	.57111367 00	-.11097225-01	.10613365 00
DY	.21844703 00	.95956843 00	.99542952 00	.93894023 00	.99999999 00	.92772487 00	.59680942 00	-.12320928-01	.34417071-01
DZ	.37000518 00	.79541320 00	.93726063 00	.97663732 00	.92772487 00	.10000000 01	.51958890 00	-.11640726-01	.13271060 00
KE	.43780725 00	.63584415 00	.61001821 00	.57111367 00	.59680942 00	.51958890 00	.10000000 01	.22445039-02	.88600897-02
KM	-.45512751-02	-.12679080-01	-.12624314-01	-.11097225-01	-.12320928-01	-.11640726-01	.22445039-02	.10000000 01	-.12524994-03
RI04	.15507759 00	-.31149828-01	.44755569-01	.10613365 00	.34417071-01	.13271060 00	.88600897-02	-.12524994-03	.10000000 01
LA04	.53914515-01	-.15704154 00	-.91023466-01	-.37968339-01	-.73338928-01	.39979208-02	.30548383-01	-.38016838-03	-.65182882-02
LO04	.14970060 00	.34346992 00	.37897206 00	.32527472 00	.41827220 00	.42002068 00	-.41733981-01	.19699563-02	-.16132261-04
RI05	.19586127 00	.12534118 00	.18964661 00	.21573874 00	.18719802 00	.26002452 00	-.15027464-01	.17456421-03	.67693467-03
LA05	.20441726 00	.13007320 00	.19708364 00	.22425761 00	.19459708 00	.27056745 00	-.15767028-01	.15659339-03	.92697588-03
LO05	-.18555555 00	-.14654298 00	-.21888477 00	-.25267697 00	-.21240534 00	-.29072769 00	.14566598-01	-.16221040-02	.36809298-02

	LA04	LO04	RI05	LA05	LO05
X	.53914515-01	.14970060 00	.19586127 00	.20441726 00	-.18555555 00
Y	-.15704154 00	.34346992 00	.12534118 00	.13007320 00	-.14654298 00
Z	-.91023466-01	.37897206 00	.18964661 00	.19708364 00	-.21888477 00
DX	-.37968339-01	.32527472 00	.21573874 00	.22425761 00	-.25267697 00
DY	-.73338928-01	.41827220 00	.18719802 00	.19459708 00	-.21240534 00
DZ	.39979208-02	.42002068 00	.26002452 00	.27056745 00	-.29072769 00
KE	.30548383-01	-.41733981-01	-.15027464-01	-.15767028-01	.14566598-01
KM	-.38016838-03	.19699563-02	.17456421-03	.15659339-03	-.16221040-02
RI04	-.65182882-02	-.16132261-04	.67693467-03	.92697588-03	.36809298-02
LA04	.10000000 01	.32164865-02	.59275871-02	.66232706-02	.10546878-01
LO04	.32164865-02	.10000000 01	-.51339670-02	-.46513165-02	.36512924-01
RI05	.59275871-02	-.51339670-02	.10000000 01	-.56450146-02	-.16469954-02
LA05	.66232706-02	-.46513165-02	-.56450146-02	.99999999 00	-.26400087-02
LO05	.10546878-01	.36512924-01	-.16469954-02	-.26400087-02	.10000000 01

STATION NUMBER 4 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 1

TIME	TC	Q	FRQ	DEC		HA		CC3	
183926	50	4	8912.9					.13121357 06 .182 00	.0078
183951	50	4	8912.9	.15735415 01 .101 00	-.0285*	.35402323 03 .101 00	-.0144*		
184026	50	4	8912.9					.13107382 06 .182 00	.0156
184051	50	4	8912.9	.16917202 01 .101 00	-.0287*	.35391487 03 .101 00	-.0320*		
184126	50	4	8912.9					.13093559 06 .182 00	.0117
184151	50	4	8912.9	.18072722 01 .101 00	-.0263*	.35381679 03 .101 00	-.0280*		
184226	50	4	8912.9					.13079889 06 .182 00	.0039
184251	50	4	8912.9	.19202983 01 .101 00	-.0274*	.35372853 03 .101 00	-.0337*		
184326	50	4	8912.9					.13066378 06 .182 00	.0000
184351	50	4	8912.9	.20308933 01 .101 00	-.0260*	.35364962 03 .101 00	-.0427*		
184426	50	4	8912.9					.13053025 06 .182 00	.0254
184451	50	4	8912.9	.21391449 01 .101 00	-.0263*	.35357963 03 .101 00	-.0048*		
184526	50	4	8912.9					.13039834 06 .182 00	-.0186
184551	50	4	8912.9	.22451387 01 .101 00	-.0303*	.35351818 03 .101 00	-.0094*		
184626	50	4	8912.9					.13026804 06 .182 00	.0010
184651	50	4	8912.9	.23489539 01 .101 00	-.0321*	.35346488 03 .101 00	.0438*		
184726	50	4	8912.9					.13013936 06 .182 00	.0010
184751	50	4	8912.9	.24506708 C1 .101 00	-.0338*	.35341938 03 .101 00	.0314*		
184826	50	4	8912.9					.13001230 06 .182 00	-.0205
184851	50	4	8912.9	.25503593 01 .101 00	-.0196*	.35338136 03 .101 00	-.0546*		
184926	50	4	8912.9					.12988686 06 .182 00	-.0195
184951	50	4	8912.9	.26480894 01 .101 00	-.0213*	.35335049 03 .101 00	-.0238*		
185026	50	4	8912.9					.12976303 06 .182 00	.0098
185051	50	4	8912.9	.27439268 01 .101 00	-.0212*	.35332650 03 .101 00	-.0038*		
185126	50	4	8912.9					.12964080 06 .182 00	-.0039
185151	50	4	8912.9	.28379365 01 .101 00	-.0192*	.35330909 03 .101 00	-.0264*		
185226	50	4	8912.9					.12952017 06 .182 00	-.0078
185251	50	4	8912.9	.29301755 01 .101 00	-.0174*	.35329802 03 .101 00	-.0154*		
185326	50	4	8912.9					.12940111 06 .182 00	-.0127
185351	50	4	8912.9	.30207027 01 .101 00	-.0159*	.35329302 03 .101 00	-.0425*		
185426	50	4	8912.9					.12928362 06 .182 00	-.0205
185451	50	4	8912.9	.31095728 01 .101 00	-.0168*	.35329388 03 .101 00	-.0433*		
185526	50	4	8912.9					.12916768 06 .182 00	.0010
185551	50	4	8912.9	.31968379 01 .101 00	-.0281*	.35330035 03 .101 00	.0640*		
185626	50	4	8912.9					.12905327 06 .182 00	-.0068
185651	50	4	8912.9	.32825481 01 .101 00	-.0218*	.35331224 03 .101 00	-.0019*		
185726	50	4	8912.9					.12894037 06 .182 00	-.0127
185751	50	4	8912.9	.33667506 01 .101 00	-.0200*	.35332935 03 .101 00	-.0210*		
185826	50	4	8912.9					.12882897 06 .182 00	.0283
185851	50	4	8912.9	.34494904 01 .101 00	-.0187*	.35335147 03 .101 00	-.0432*		
185926	50	4	8912.9					.12871905 06 .182 00	-.0078
185951	50	4	8912.9	.35308121 01 .101 00	-.0181*	.35337845 03 .101 00	-.0623*		
193326	50	4	8276.5					.12571637 06 .183 00	.0244
193351	50	4	8276.5	.56739149 01 .101 00	-.0203*	.35631000 03 .101 00	-.0769*		
193826	50	4	8276.5					.12537175 06 .183 00	.0303
193851	50	4	8276.5	.59152952 01 .101 00	-.0195*	.35696676 03 .101 00	-.0303*		
193926	50	4	8276.5					.12530519 06 .183 00	-.0088
193951	50	4	8276.5	.59619076 01 .101 00	-.0200*	.35710292 03 .101 00	-.0326*		
194226	50	4	8276.5					.12511001 06 .183 00	.0127
194251	50	4	8276.5	.60986073 01 .101 00	-.0345*	.35752034 03 .101 00	-.0164*		
194326	50	4	8276.5					.12504641 06 .183 00	.0322
194351	50	4	8276.5	.61431611 01 .101 00	-.0251*	.35766235 03 .101 00	.0055*		
194426	50	4	8276.5					.12498352 06 .183 00	.0000
194451	50	4	8276.5	.61872251 01 .101 00	-.0111*	.35780577 03 .101 00	-.0240*		

STATION NUMBER 4   62/10/18   ITERATION NUMBER 3   PASS NUMBER 10/181   PAGE 2

TIME	TC	G	FRQ	DEC		HA		CC3	
194526	50	4	8276.5					.12492133 06 .183 00	.0068
194551	50	4	8276.5	.62308068 01 .101 00	-.0526*	.35795052 03 .101 00	-.0330*		
194626	50	4	8276.5					.12485984 06 .183 00	.0039
194651	50	4	8276.5	.62739139 01 .101 00	-.0077*	.35809663 03 .101 00	-.0312*		
194726	50	4	8276.5					.12479902 06 .183 00	.0020
194751	50	4	8276.5	.63165575 01 .101 00	-.0323*	.35824401 03 .101 00	-.0406*		
194826	50	4	8276.5					.12473887 06 .183 00	.0127
194851	50	4	8276.5	.63587463 01 .101 00	-.0304*	.35839267 03 .101 00	-.0354*		
194926	50	4	8276.5					.12467937 06 .183 00	.0244
194951	50	4	8276.5	.64004871 01 .101 00	-.0101*	.35854259 03 .101 00	-.0475*		
195026	50	4	8276.5					.12462053 06 .183 00	.0088
195051	50	4	8276.5	.64417873 01 .101 00	-.0454*	.35869372 03 .101 00	-.0527*		
195126	50	4	8276.5					.12456232 06 .183 00	.0557
195151	50	4	8276.5	.64826565 01 .101 00	-.0262*	.35884606 03 .101 00	-.0372*		
195226	50	4	8276.5					.12450475 06 .183 00	-.0078
195251	50	4	8276.5	.65230998 01 .101 00	-.0245*	.35899955 03 .101 00	-.0388*		
195326	50	4	8276.5					.12444779 06 .183 00	-.0283
195351	50	4	8276.5	.65631265 01 .101 00	-.0365*	.35915421 03 .101 00	-.0396*		
195426	50	4	8276.5					.12439144 06 .183 00	.0215
195451	50	4	8276.5	.66027419 01 .101 00	-.0241*	.35930998 03 .101 00	-.0375*		
195526	50	4	8276.5					.12433569 06 .183 00	.0098
195551	50	4	8276.5	.66419552 01 .101 00	-.0313*	.35946685 03 .101 00	-.0425*		
195626	50	4	8276.5					.12428053 06 .183 00	.0059
195651	50	4	8276.5	.66807717 01 .101 00	-.0300*	.35962481 03 .101 00	-.0406*		
195726	50	4	8276.5					.12422596 06 .183 00	-.0176
195751	50	4	8276.5	.67191988 01 .101 00	-.0144*	.35978383 03 .101 00	-.0377*		
195826	50	4	8276.5					.12417196 06 .183 00	.0039
195926	50	4	8276.5					.12411852 06 .183 00	-.0010
200026	50	4	8276.5					.12406564 06 .183 00	-.0029
200051	50	4	8276.5	.68322055 01 .101 00	-.0232*	.26703244 00 .101 00	-.0314*		
200126	50	4	8276.5					.12401331 06 .183 00	-.0137
200151	50	4	8276.5	.68691364 01 .101 00	-.0141*	.43008431 00 .101 00	-.0365*		
200226	50	4	8276.5					.12396152 06 .183 00	-.0059
200251	50	4	8276.5	.69057078 01 .101 00	-.0206*	.59410468 00 .101 00	-.0427*		
200326	50	4	8276.5					.12391027 06 .183 00	.0303
200351	50	4	8276.5	.69419266 01 .101 00	-.0247*	.75906304 00 .101 00	-.0417*		
200426	50	4	8276.5					.12385954 06 .183 00	-.0020
200451	50	4	8276.5	.69777972 01 .101 00	-.0225*	.92494795 00 .101 00	-.0358*		
200526	50	4	8276.5					.12380933 06 .183 00	.0107
200551	50	4	8276.5	.70133263 01 .101 00	-.0280*	.10917442 01 .101 00	-.0327*		
200626	50	4	8276.5					.12375963 06 .183 00	.0303
200651	50	4	8276.5	.70485191 01 .101 00	-.0251*	.12594326 01 .101 00	-.0345*		
200726	50	4	8276.5					.12371043 06 .183 00	-.0117
200751	50	4	8276.5	.70833798 01 .101 00	-.0299*	.14280018 01 .101 00	-.0332*		
200826	50	4	8276.5					.12366173 06 .183 00	-.0107
200851	50	4	8276.5	.71179144 01 .101 00	-.0284*	.15974252 01 .101 00	-.0408*		
200926	50	4	8276.5					.12361352 06 .183 00	.0205
200951	50	4	8276.5	.71521272 01 .101 00	-.0245*	.17676950 01 .101 00	-.0411*		
201026	50	4	8276.5					.12356579 06 .183 00	.0107
201051	50	4	8276.5	.71860231 01 .101 00	-.0164*	.19387998 01 .102 00	-.0425*		
201126	50	4	8276.5					.12351853 06 .183 00	.0039
201151	50	4	8276.5	.72196075 01 .101 00	-.0139*	.21107129 01 .102 00	-.0425*		
201226	50	4	8276.5					.12347175 06 .183 00	.0098
201251	50	4	8276.5	.72528855 01 .101 00	-.0211*	.22834344 01 .102 00	-.0353*		

STATION NUMBER 4 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 3

TIME	TC	Q	FRQ	DEC		HA		CC3	
201326	50	4	8276.5					.12342543 06 .183 00	.0117
201351	50	4	8276.5	.72858595 01 .101 00	-.0220*	.24569375 01 .102 00	-.0430*		
201426	50	4	8276.5					.12337956 06 .183 00	-.0020
201451	50	4	8276.5	.73185363 01 .101 00	-.0246*	.26312108 01 .102 00	-.0333*		
201526	50	4	8276.5					.12333414 06 .183 00	-.0049
201551	50	4	8276.5	.73509195 01 .101 00	-.0289*	.28062505 01 .102 00	-.0386*		
201626	50	4	8276.5					.12328917 06 .183 00	.0068
201651	50	4	8276.5	.73830125 01 .101 00	-.0289*	.29820337 01 .102 00	-.0405*		
201726	50	4	8276.5					.12324464 06 .183 00	-.0176
201751	50	4	8276.5	.74148202 01 .101 00	-.0167*	.31585527 01 .102 00	-.0371*		
201826	50	4	8276.5					.12320053 06 .183 00	.0059
201851	50	4	8276.5	.74463479 01 .101 00	-.0281*	.33357924 01 .102 00	-.0444*		
202326	50	4	8276.5					.12298629 06 .183 00	.0088
202351	50	4	8276.5	.75998999 01 .101 00	-.0313*	.42323995 01 .102 00	-.0378*		
202426	50	4	8276.5					.12294466 06 .183 00	-.0186
202451	50	4	8276.5	.76298206 01 .101 00	-.0292*	.44137264 01 .102 00	-.0453*		
202626	50	4	8276.5					.12286257 06 .183 00	.0117
202651	50	4	8276.5	.76889005 01 .101 00	-.0321*	.47782904 01 .102 00	-.0541*		
202726	50	4	8276.5					.12282210 06 .183 00	.0010
202751	50	4	8276.5	.77180672 01 .101 00	-.0212*	.49615046 01 .102 00	-.0454*		
202826	50	4	8276.5					.12278201 06 .183 00	-.0273
202851	50	4	8276.5	.77469889 01 .101 00	-.0100*	.51453364 01 .102 00	-.0474*		
202926	50	4	8276.5					.12274229 06 .183 00	-.0488
202951	50	4	8276.5	.77756698 01 .101 00	-.0286*	.53297705 01 .102 00	-.0640*		
203126	50	4	8276.5					.12266395 06 .183 00	-.0107
203151	50	4	8276.5	.78323184 01 .101 00	-.0111*	.57004002 01 .102 00	-.0828*		
203226	50	4	8276.5					.12262532 06 .183 00	-.0029
203251	50	4	8276.5	.78602940 01 .101 00	-.0290*	.58865806 01 .102 00	-.0713*		
203326	50	4	8276.5					.12258705 06 .183 00	-.0469
203351	50	4	8276.5	.78880405 01 .101 00	-.0366*	.60733290 01 .102 00	-.0640*		
203426	50	4	8276.5					.12254912 06 .183 00	-.0430
203451	50	4	8276.5	.79155608 01 .101 00	-.0141*	.62606263 01 .102 00	-.0535*		
203526	50	4	8276.5					.12251154 06 .183 00	-.0420
203551	50	4	8276.5	.79428583 01 .101 00	-.0153*	.64484765 01 .102 00	-.0754*		
203626	50	4	8276.5					.12247430 06 .183 00	-.0420
203651	50	4	8276.5	.79699352 01 .101 00	-.0223*	.66368642 01 .102 00	-.0801*		
203726	50	4	8276.5					.12243740 06 .183 00	-.0195
203751	50	4	8276.5	.79967945 01 .101 00	-.0110*	.68257818 01 .102 00	-.0652*		
203826	50	4	8276.5					.12240083 06 .183 00	-.0088
203851	50	4	8276.5	.80234393 01 .101 00	-.0336*	.70152256 01 .102 00	-.0767*		
203926	50	4	8276.5					.12236458 06 .183 00	.0342
203951	50	4	8276.5	.80498725 01 .101 00	-.0039*	.72051802 01 .102 00	-.0608*		
204026	50	4	8276.5					.12232866 06 .183 00	-.0059
204051	50	4	8276.5	.80760953 01 .101 00	-.0301*	.73956455 01 .102 00	-.0654*		
204126	50	4	8276.5					.12229307 06 .183 00	-.0273
204151	50	4	8276.5	.81021117 01 .101 00	-.0280*	.75866103 01 .102 00	-.0725*		
204226	50	4	8276.5					.12225778 06 .183 00	-.0439
204251	50	4	8276.5	.81279247 01 .101 00	-.0217*	.77780631 01 .102 00	-.0681*		
204326	50	4	8276.5					.12222281 06 .183 00	-.0332
204351	50	4	8276.5	.81535352 01 .101 00	-.0233*	.79700039 01 .102 00	-.0801*		
204426	50	4	8276.5					.12218815 06 .183 00	-.0498
204451	50	4	8276.5	.81789467 01 .101 00	-.0365*	.81624211 01 .102 00	-.0867*		
204526	50	4	8276.5					.12215379 06 .183 00	-.0107
204551	50	4	8276.5	.82041617 01 .101 00	-.0217*	.83553110 01 .102 00	-.0876*		

STATION NUMBER 4 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 4

TIME	TC	Q	FRQ	DEC		HA		CC3	
204626	50	4	8276.5					.12211973 06 .184 00	-.0332
204651	50	4	8276.5	.82291812 01 .101 00	-.0106*	.85486623 01 .102 00	-.1072*		
204726	50	4	8276.5					.12208597 06 .184 00	.0088
204751	50	4	8276.5	.82540092 01 .101 00	-.0253*	.87424746 01 .102 00	-.1072*		
204826	50	4	8276.5					.12205250 06 .184 00	-.0039
204851	50	4	8276.5	.82786477 01 .101 00	-.0239*	.89367331 01 .102 00	-.0955*		
204926	50	4	8276.5					.12201933 06 .184 00	-.0068
204951	50	4	8276.5	.83030990 01 .101 00	-.0242*	.91314338 01 .102 00	-.0784*		
205026	50	4	8276.5					.12198643 06 .184 00	-.0352
205051	50	4	8276.5	.83273642 01 .101 00	-.0364*	.93265804 01 .102 00	-.0737*		
205126	50	4	8276.5					.12195383 06 .184 00	-.0264
205151	50	4	8276.5	.83514465 01 .101 00	-.0284*	.95221502 01 .102 00	-.0693*		
205226	50	4	8276.5					.12192150 06 .184 00	.0215
205251	50	4	8276.5	.83753467 01 .101 00	-.0162*	.97181506 01 .102 00	-.0835*		
205326	50	4	8276.5					.12188945 06 .184 00	-.0068
205351	50	4	8276.5	.83990676 01 .101 00	-.0198*	.99145665 01 .102 00	-.0720*		
205426	50	4	8276.5					.12185767 06 .184 00	-.0068
205451	50	4	8276.5	.84226134 01 .101 00	-.0192*	.10111394 02 .102 00	-.0830*		
205526	50	4	8276.5					.12182616 06 .184 00	-.0566
205551	50	4	8276.5	.84459823 01 .101 00	-.0245*	.10308633 02 .102 00	-.0564*		
205626	50	4	8276.5					.12179491 06 .184 00	-.0127
205651	50	4	8276.5	.84691803 01 .101 00	-.0355*	.10506273 02 .102 00	-.0542*		
205726	50	4	8276.5					.12176393 06 .184 00	-.0127
205751	50	4	8276.5	.84922074 01 .101 00	-.0165*	.10704309 02 .102 00	-.0464*		
205826	50	4	8276.5					.12173321 06 .184 00	.0068
205851	50	4	8276.5	.85150644 01 .101 00	-.0233*	.10902733 02 .102 00	-.0669*		
205926	50	4	8276.5					.12170275 06 .184 00	-.0107
205951	50	4	8276.5	.85377540 01 .101 00	-.0218*	.11101547 02 .102 00	-.0558*		
210026	50	4	8276.5					.12167254 06 .184 00	-.0225
210051	50	4	8276.5	.85602779 01 .101 00	-.0262*	.11300738 02 .102 00	-.0571*		
210126	50	4	8276.5					.12164258 06 .184 00	-.0049
210151	50	4	8276.5	.85826394 01 .101 00	-.0265*	.11500302 02 .102 00	-.0608*		
210226	50	4	8276.5					.12161288 06 .184 00	.0039
210251	50	4	8276.5	.86048394 01 .101 00	-.0126*	.11700240 02 .102 00	-.0490*		
210326	50	4	8276.5					.12158341 06 .184 00	-.0322
210351	50	4	8276.5	.86268795 01 .101 00	-.0345*	.11900539 02 .102 00	-.0574*		
210426	50	4	8276.5					.12155419 06 .184 00	.0078
210451	50	4	8276.5	.86487606 01 .101 00	.0037*	.12101201 02 .102 00	-.0422*		
210526	50	4	8276.5					.12152521 06 .184 00	-.0107
210551	50	4	8276.5	.86704864 01 .101 00	-.0179*	.12302214 02 .102 00	-.0553*		
210626	50	4	8276.5					.12149647 06 .184 00	.0342
210651	50	4	8276.5	.86920564 01 .101 00	-.0393*	.12503581 02 .102 00	-.0608*		
210726	50	4	8276.5					.12146795 06 .184 00	.0244
210751	50	4	8276.5	.87134743 01 .101 00	-.0206*	.12705287 02 .102 00	-.0487*		
210826	50	4	8276.5					.12143968 06 .184 00	-.0381
210851	50	4	8276.5	.87347402 01 .101 00	-.0198*	.12907336 02 .102 00	-.0508*		
210926	50	4	8276.5					.12141163 06 .184 00	.0117
210951	50	4	8276.5	.87558573 01 .101 00	-.0268*	.13109724 02 .102 00	-.0574*		
211026	50	4	8276.5					.12138380 06 .184 00	.0352
211051	50	4	8276.5	.87768249 01 .101 00	-.0217*	.13312440 02 .102 00	-.0602*		
211126	50	4	8276.5					.12135620 06 .184 00	-.0254
211151	50	4	8276.5	.87976464 01 .101 00	-.0124*	.13515487 02 .102 00	-.0713*		
211226	50	4	8276.5					.12132883 06 .184 00	.0127
211251	50	4	8276.5	.88183232 01 .101 00	-.0330*	.13718855 02 .102 00	-.0850*		

STATION NUMBER 4 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 5

TIME	TC	Q	FRQ	DEC		HA		CC3	
211326	50	4	8276.5					.12130167 06 .184 00	.0313
211351	50	4	8276.5	.88388565 01 .101 00	-.0173*	.13922547 02 .102 00	-.0708*		
211426	50	4	8276.5					.12127472 06 .184 00	.0146
211451	50	4	8276.5	.88592462 01 .101 00	-.0216*	.14126546 02 .102 00	-.1008*		
211526	50	4	8276.5					.12124799 06 .184 00	.0049
211551	50	4	8276.5	.88794965 01 .101 00	-.0178*	.14330855 02 .102 00	-.0913*		
211626	50	4	8276.5					.12122148 06 .184 00	.0020
211651	50	4	8276.5	.88996077 01 .101 00	-.0278*	.14535476 02 .102 00	-.0920*		
211726	50	4	8276.5					.12119517 06 .184 00	-.0088
211751	50	4	8276.5	.89195809 01 .101 00	-.0096*	.14740395 02 .102 00	-.0811*		
211826	50	4	8276.5					.12116906 06 .184 00	.0137
211851	50	4	8276.5	.89394175 01 .101 00	-.0293*	.14945618 02 .102 00	-.0825*		
211926	50	4	8276.5					.12114317 06 .184 00	.0313
211951	50	4	8276.5	.89591189 01 .101 00	-.0488*	.15151131 02 .102 00	-.0881*		
212126	50	4	8276.5					.12109198 06 .184 00	.0244
212151	50	4	8276.5	.89981234 01 .101 00	-.0276*	.15563032 02 .102 00	-.1062*		
212226	50	4	8276.5					.12106668 06 .184 00	.0020
212251	50	4	8276.5	.90174280 01 .101 00	-.0049*	.15769406 02 .102 00	-.1665*		
212326	50	4	8276.5					.12104157 06 .184 00	.0049
212351	50	4	8276.5	.90366036 01 .101 00	-.0239*	.15976066 02 .102 00	-.1475*		
212426	50	4	8276.5					.12101666 06 .184 00	.0352
212451	50	4	8276.5	.90556509 01 .101 00	-.0088*	.16182995 02 .102 00	-.0767*		
212526	50	4	8276.5					.12099195 06 .184 00	.0146
212551	50	4	8276.5	.90745699 01 .101 00	-.0276*	.16390204 02 .102 00	-.0840*		
212626	50	4	8276.5					.12096742 06 .184 00	.0225
212651	50	4	8276.5	.90933641 01 .101 00	.0017*	.16597678 02 .102 00	-.1035*		
212726	50	4	8276.5					.12094307 06 .184 00	.0254
212751	50	4	8276.5	.91120333 01 .101 00	-.0148*	.16805423 02 .102 00	-.1372*		
212826	50	4	8276.5					.12091891 06 .184 00	.0049
212851	50	4	8276.5	.91305795 01 .101 00	-.0332*	.17013424 02 .102 00	-.1558*		
212926	50	4	8276.5					.12089494 06 .184 00	.0195
212951	50	4	8276.5	.91490033 01 .101 00	-.0135*	.17221683 02 .102 00	-.0779*		
213026	50	4	8276.5					.12087115 06 .184 00	-.0068
213051	50	4	8276.5	.91673055 01 .101 00	-.0256*	.17430209 02 .102 00	-.0825*		
213126	50	4	8276.5					.12084753 06 .184 00	.0078
213151	50	4	8276.5	.91854890 01 .101 00	-.0017*	.17638978 02 .102 00	-.0854*		
213226	50	4	8276.5					.12082409 06 .184 00	.0264
213251	50	4	8276.5	.92035527 01 .101 00	-.0197*	.17848003 02 .102 00	-.1167*		
213326	50	4	8276.5					.12080083 06 .184 00	.0303
213351	50	4	8276.5	.92214992 01 .101 00	-.0175*	.18057272 02 .102 00	-.1343*		
213426	50	4	8276.5					.12077774 06 .184 00	.0010
213451	50	4	8276.5	.92393292 01 .101 00	.0008*	.18266784 02 .102 00	-.1299*		
213526	50	4	8276.5					.12075482 06 .184 00	.0205
213551	50	4	8276.5	.92570439 01 .101 00	-.0167*	.18476540 02 .102 00	-.0715*		
213626	50	4	8276.5					.12073207 06 .184 00	.0303
213651	50	4	8276.5	.92746447 01 .101 00	-.0342*	.18686529 02 .102 00	-.0718*		
213726	50	4	8276.5					.12070949 06 .184 00	-.0068
213751	50	4	8276.5	.92921317 01 .101 00	-.0235*	.18896761 02 .102 00	-.0621*		
213826	50	4	8276.5					.12068707 06 .184 00	.0098
213851	50	4	8276.5	.93095057 01 .101 00	-.0187*	.19107217 02 .102 00	-.0568*		
213926	50	4	8276.5					.12066482 06 .184 00	-.0166
213951	50	4	8276.5	.93267693 01 .101 00	-.0139*	.19317910 02 .102 00	-.0515*		
214026	50	4	8276.5					.12064272 06 .184 00	.0137
214051	50	4	8276.5	.93439244 01 .101 00	-.0249*	.19528824 02 .102 00	-.0725*		

STATION NUMBER 4 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 6

TIME	TC	Q	FRQ	DEC		HA		CC3	
214126	50	4	8276.5					.12062079 06 .184 00	.0049
214151	50	4	8276.5	.93609681 01 .101 00	-.0138*	.19739958 02 .102 00	-.0879*		
214226	50	4	8276.5					.12059902 06 .184 00	-.0039
214251	50	4	8276.5	.93779048 01 .101 00	-.0066*	.19951321 02 .102 00	-.1152*		
214326	50	4	8276.5					.12057741 06 .184 00	.0313
214351	50	4	8276.5	.93947345 01 .101 00	-.0233*	.20162897 02 .102 00	-.0869*		
214426	50	4	8276.5					.12055595 06 .184 00	-.0088
214451	50	4	8276.5	.94114573 01 .101 00	-.0139*	.20374694 02 .102 00	-.1631*		
214526	50	4	8276.5					.12053464 06 .184 00	.0381
214551	50	4	8276.5	.94280756 01 .101 00	.0017*	.20586700 02 .102 00	-.0331*		
214626	50	4	8276.5					.12051349 06 .184 00	-.0078
214651	50	4	8276.5	.94445895 01 .101 00	-.0387*	.20798919 02 .102 00	-.0994*		
214726	50	4	8276.5					.12049248 06 .184 00	.0176
214751	50	4	8276.5	.94610006 01 .101 00	-.0189*	.21011344 02 .102 00	-.0220*		
214826	50	4	8276.5					.12047163 06 .184 00	-.0078
214851	50	4	8276.5	.94773081 01 .101 00	-.0111*	.21223971 02 .102 00	-.0828*		
214926	50	4	8276.5					.12045092 06 .185 00	-.0186
214951	50	4	8276.5	.94935153 01 .101 00	-.0272*	.21436810 02 .102 00	-.0977*		
215026	50	4	8276.5					.12043035 06 .185 00	.0039
215051	50	4	8276.5	.95096217 01 .101 00	-.0231*	.21649844 02 .102 00	-.0869*		
215126	50	4	8276.5					.12040993 06 .185 00	.0039
215151	50	4	8276.5	.95256288 01 .101 00	.0010*	.21863079 02 .102 00	-.0784*		
215226	50	4	8276.5					.12038966 06 .185 00	-.0400
215251	50	4	8276.5	.95415355 01 .101 00	-.0047*	.22076505 02 .102 00	-.0779*		
215326	50	4	8276.5					.12036952 06 .185 00	-.0029
215351	50	4	8276.5	.95573455 01 .101 00	-.0344*	.22290132 02 .102 00	-.1096*		
215426	50	4	8276.5					.12034952 06 .185 00	-.0068
215451	50	4	8276.5	.95730579 01 .101 00	-.0160*	.22503946 02 .102 00	-.1636*		
215526	50	4	8276.5					.12032967 06 .185 00	-.0273
215551	50	4	8276.5	.95886750 01 .101 00	.0025*	.22717946 02 .102 00	-.1958*		
215626	50	4	8276.5					.12030994 06 .185 00	-.0049
215651	50	4	8276.5	.96041954 01 .101 00	-.0088*	.22932141 02 .102 00	-.1401*		
215726	50	4	8276.5					.12029036 06 .185 00	-.0371
215751	50	4	8276.5	.96196225 01 .101 00	-.0240*	.23146514 02 .102 00	-.0784*		
215826	50	4	8276.5					.12027090 06 .185 00	.0166
215851	50	4	8276.5	.96349546 01 .101 00	-.0173*	.23361073 02 .102 00	-.1211*		
215926	50	4	8276.5					.12025158 06 .185 00	.0186
215951	50	4	8276.5	.96501949 01 .101 00	-.0123*	.23575811 02 .102 00	-.1221*		
220026	50	4	8276.5					.12023239 06 .185 00	.0303
220051	50	4	8276.5	.96653426 01 .101 00	-.0073*	.23790728 02 .102 00	-.0950*		
220126	50	4	8276.5					.12021333 06 .185 00	.0322
220151	50	4	8276.5	.96803987 01 .101 00	-.0222*	.24005824 02 .102 00	-.1042*		
220226	50	4	8276.5					.12019439 06 .185 00	.0068
220251	50	4	8276.5	.96953639 01 .101 00	-.0330*	.24221087 02 .102 00	-.0977*		
220326	50	4	8276.5					.12017558 06 .185 00	.0146
220351	50	4	8276.5	.97102400 01 .101 00	-.0177*	.24436529 02 .102 00	-.0872*		
220426	50	4	8276.5					.12015690 06 .185 00	.0371
220451	50	4	8276.5	.97250269 01 .101 00	-.0164*	.24652137 02 .102 00	-.0930*		
220526	50	4	8276.5					.12013834 06 .185 00	-.0244
220551	50	4	8276.5	.97397247 01 .101 00	-.0249*	.24867918 02 .103 00	-.0989*		
220626	50	4	8276.5					.12011991 06 .185 00	.0127
220651	50	4	8276.5	.97543359 01 .101 00	-.0153*	.25083861 02 .103 00	-.1069*		
220726	50	4	8276.5					.12010159 06 .185 00	.0273
220751	50	4	8276.5	.97688596 01 .101 00	-.0177*	.25299968 02 .103 00	-.0991*		

STATION NUMBER 4 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 7

TIME	TC	Q	FRQ	DEC		HA		CC3	
220826	50	4	8276.5					.12008340 06 .185 00	.0029
220851	50	4	8276.5	.97832968 01 .101 00	-.0139*	.25516242 02 .103 00	-.0977*		
220926	50	4	8276.5					.12006532 06 .185 00	.0000
220951	50	4	8276.5	.97976498 01 .101 00	-.0201*	.25732672 02 .103 00	-.1140*		
221026	50	4	8276.5					.12004736 06 .185 00	-.0020
221051	50	4	8276.5	.98119164 01 .101 00	-.0183*	.25949266 02 .103 00	-.1729*		
221126	50	4	8276.5					.12002952 06 .185 00	-.0176
221151	50	4	8276.5	.98261005 01 .101 00	.0117*	.26166011 02 .103 00	-.1616*		
221226	50	4	8276.5					.12001179 06 .185 00	.0303
221251	50	4	8276.5	.98402005 01 .101 00	-.0282*	.26382921 02 .103 00	-.1387*		
221326	50	4	8276.5					.11999417 06 .185 00	-.0156
221351	50	4	8276.5	.98542184 01 .101 00	-.0002*	.26599978 02 .103 00	-.3223*		
221426	50	4	8276.5					.11997667 06 .185 00	.0264
221451	50	4	8276.5	.98681527 01 .101 00	-.0158*	.26817184 02 .103 00	-.1294*		
221526	50	4	8276.5					.11995928 06 .185 00	-.0215
221551	50	4	8276.5	.98820083 01 .101 00	-.0155*	.27034542 02 .103 00	-.1167*		
221626	50	4	8276.5					.11994200 06 .185 00	.0000
221651	50	4	8276.5	.98957815 01 .101 00	-.0131*	.27252048 02 .103 00	-.1382*		
221726	50	4	8276.5					.11992483 06 .185 00	-.0088
221751	50	4	8276.5	.99094748 01 .101 00	-.0206*	.27469701 02 .103 00	-.0981*		
221826	50	4	8276.5					.11990776 06 .185 00	-.0439
221851	50	4	8276.5	.99230876 01 .101 00	-.0101*	.27687499 02 .103 00	-.1519*		
221926	50	4	8276.5					.11989081 06 .185 00	.0527
221951	50	4	8276.5	.99366239 01 .101 00	-.0234*	.27905440 02 .103 00	-.1523*		
222026	50	4	8276.5					.11987395 06 .185 00	-.0146
222051	50	4	8276.5	.99500811 01 .101 00	-.0128*	.28123518 02 .103 00	-.1943*		
222226	50	4	8276.5					.11984056 06 .185 00	-.0010
222251	50	4	8276.5	.99767631 01 .101 00	-.0231*	.28560100 02 .103 00	-.1733*		
222326	50	4	8276.5					.11982402 06 .185 00	.0225
222351	50	4	8276.5	.99899885 01 .101 00	.0219*	.28778598 02 .103 00	-.1577*		
222426	50	4	8276.5					.11980757 06 .185 00	.0244
222451	50	4	8276.5	.10003139 02 .101 00	-.0231*	.28997230 02 .103 00	-.1548*		
222526	50	4	8276.5					.11979123 06 .185 00	-.0127
222551	50	4	8276.5	.10016215 02 .101 00	-.0240*	.29215996 02 .103 00	-.2212*		
222626	50	4	8276.5					.11977499 06 .185 00	-.0098
222651	50	4	8276.5	.10029216 02 .101 00	-.0048*	.29434894 02 .103 00	-.1606*		
222726	50	4	8276.5					.11975884 06 .185 00	.0166
222751	50	4	8276.5	.10042143 02 .101 00	-.0175*	.29653923 02 .103 00	-.0776*		
222826	50	4	8276.5					.11974279 06 .185 00	.0059
222851	50	4	8276.5	.10054996 02 .101 00	-.0302*	.29873082 02 .103 00	-.1089*		
222926	50	4	8276.5					.11972684 06 .185 00	-.0010
222951	50	4	8276.5	.10067776 02 .101 00	-.0147*	.30092368 02 .103 00	-.1204*		
223026	50	4	8276.5					.11971098 06 .185 00	-.0225
223051	50	4	8276.5	.10080485 02 .101 00	-.0233*	.30311781 02 .103 00	-.1218*		
223126	50	4	8276.5					.11969522 06 .185 00	-.0176
223151	50	4	8276.5	.10093123 02 .101 00	-.0217*	.30531318 02 .103 00	-.1116*		
223226	50	4	8276.5					.11967954 06 .185 00	-.0049
223251	50	4	8276.5	.10105688 02 .101 00	-.0181*	.30750977 02 .103 00	-.1255*		
223326	50	4	8276.5					.11966396 06 .185 00	.0566
223351	50	4	8276.5	.10118183 02 .101 00	-.0304*	.30970760 02 .103 00	-.1152*		
223426	50	4	8276.5					.11964847 06 .185 00	.0273
223451	50	4	8276.5	.10130608 02 .101 00	-.0128*	.31190664 02 .103 00	-.2910*		
223526	50	4	8276.5					.11963307 06 .185 00	-.0117
223551	50	4	8276.5	.10142963 02 .101 00	-.0168*	.31410687 02 .103 00	-.2114*		

STATION NUMBER 4 o2/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 8

TIME	TC	Q	FRQ	DEC		HA		CC3	
223626	50	4	8276.5					.11961776 06 .185 00	.0010
223651	50	4	8276.5	.10155250 02 .101 00	-.0269*	.31630828 02 .103 00	-.1255*		
223726	50	4	8276.5					.11960253 06 .185 00	-.0156
223751	50	4	8276.5	.10167468 02 .101 00	-.0130*	.31851087 02 .103 00	-.2656*		
223826	50	4	8276.5					.11958740 06 .185 00	.0029
223851	50	4	8276.5	.10179617 02 .101 00	-.0189*	.32071460 02 .103 00	-.1943*		
223926	50	4	8276.5					.11957234 06 .185 00	-.0039
223951	50	4	8276.5	.10191699 02 .101 00	-.0168*	.32291947 02 .103 00	-.2451*		
224026	50	4	8276.5					.11955738 06 .185 00	.0029
224051	50	4	8276.5	.10203716 02 .101 00	-.0167*	.32512546 02 .103 00	-.2480*		
224126	50	4	8276.5					.11954249 06 .185 00	-.0127
224151	50	4	8276.5	.10215664 02 .101 00	-.0105*	.32733259 02 .103 00	-.3047*		
224226	50	4	8276.5					.11952769 06 .185 00	.0078
224251	50	4	8276.5	.10227546 02 .101 00	-.0162*	.32954082 02 .103 00	-.2813*		
224326	50	4	8276.5					.11951297 06 .185 00	.0068
224351	50	4	8276.5	.10239365 C2 .102 00	-.0158*	.33175014 02 .103 00	-.2988*		
224426	50	4	8276.5					.11949833 06 .185 00	-.0352
224526	50	4	8276.5					.11948378 06 .186 00	.0615
224551	50	4	8276.5	.10262805 02 .102 00	.2998*	.33617196 02 .103 00	-2.3516*		
231026	50	4	8276.5					.11914345 06 .186 00	-.0479
231051	50	4	8276.5	.10535323 02 .102 00	-.0740*	.39177232 02 .103 00	-.1323*		
231126	50	4	8276.5					.11913068 06 .186 00	-.0059
231151	50	4	8276.5	.10545485 02 .102 00	-.0840*	.39400768 02 .103 00	-.1758*		
231226	50	4	8276.5					.11911798 06 .186 00	.0186
231251	50	4	8276.5	.10555595 02 .102 00	-.0938*	.39624380 02 .103 00	-.1938*		
231726	50	4	8276.5					.11905532 06 .186 00	.0342
231751	50	4	8276.5	.10605348 02 .102 00	-.0224*	.40743598 02 .103 00	-.1934*		
231926	50	4	8276.5					.11903065 06 .186 00	.0088
231951	50	4	8276.5	.10624890 02 .102 00	-.0175*	.41191803 02 .103 00	-.2358*		
232026	50	4	8276.5					.11901839 06 .186 00	-.0127
232051	50	4	8276.5	.10634584 02 .102 00	-.0269*	.41416014 02 .104 00	-.1104*		
232126	50	4	8276.5					.11900619 06 .186 00	-.0293
232151	50	4	8276.5	.10644227 02 .102 00	-.0363*	.41640296 02 .104 00	-.0469*		
232226	50	4	8276.5					.11899403 06 .186 00	.0244
232251	50	4	8276.5	.10653822 02 .102 00	-.0296*	.41864648 02 .104 00	-.0874*		
232326	50	4	8276.5					.11898193 06 .186 00	-.0352
232351	50	4	8276.5	.10663367 02 .102 00	-.0330*	.42089069 02 .104 00	-.1499*		
232426	50	4	8276.5					.11896988 06 .186 00	-.0254
232451	50	4	8276.5	.10672861 02 .102 00	-.0242*	.42313558 02 .104 00	-.1606*		
232526	50	4	8276.5					.11895788 06 .186 00	-.0254
232551	50	4	8276.5	.10682308 02 .102 00	-.0294*	.42538113 02 .104 00	-.0811*		
232626	50	4	8276.5					.11894593 06 .186 00	.0264
232651	50	4	8276.5	.10691705 02 .102 00	-.0345*	.42762737 02 .104 00	-.0640*		
232726	50	4	8276.5					.11893403 06 .186 00	.0078
232751	50	4	8276.5	.10701054 02 .102 00	-.0276*	.42987427 02 .104 00	-.0847*		
233802	0	0	.0	.10793575 02 .102 00	-.0317*	.45279098 02 .104 00	-.0957*		
233902	0	0	.0	.10802403 02 .102 00	-.0283*	.45504475 02 .104 00	-.0991*		
234002	0	0	.0	.10811186 02 .102 00	-.0308*	.45729908 02 .104 00	-.0889*		
234102	0	0	.0	.10819926 02 .102 00	-.0372*	.45955398 02 .104 00	-.0344*		
234202	0	0	.0	.10828620 02 .102 00	-.0197*	.46180944 02 .104 00	-.0859*		
234302	0	0	.0	.10837271 02 .102 00	-.0261*	.46406544 02 .104 00	-.0737*		
234402	0	0	.0	.10845878 C2 .102 C0	-.0344*	.46632198 02 .104 00	-.0735*		
234502	0	0	.0	.10854440 02 .102 00	-.0367*	.46857907 02 .104 00	-.0713*		
234602	0	0	.0	.10862961 02 .102 00	-.0331*	.47083668 02 .104 00	-.0833*		

STATION NUMBER 4 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/181 PAGE 9

CC3

TIME	TC	Q	FRQ	DEC		HA	
234702	0	0	.0	.10871438 02 .102 00	-.0332*	.47309482 02 .104 00	-.0913*
234802	0	0	.0	.10879873 02 .102 00	-.0394*	.47535348 02 .104 00	-.0833*
234902	0	0	.0	.10888264 02 .102 00	-.0195*	.47761263 02 .104 00	-.0713*
235002	0	0	.0	.10896614 02 .103 00	-.0276*	.47987229 02 .104 00	-.0994*
235102	0	0	.0	.10904922 02 .103 00	-.0178*	.48213245 02 .104 00	-.1294*
235202	0	0	.0	.10913187 02 .103 00	-.0278*	.48439310 02 .104 00	-.1377*
235302	0	0	.0	.10921411 02 .103 00	-.0356*	.48665425 02 .104 00	-.1060*
235402	0	0	.0	.10929593 02 .103 00	-.0436*	.48891587 02 .104 00	-.0962*
235502	0	0	.0	.10937734 C2 .103 00	.0025*	.49117795 02 .104 00	-.1006*
235602	0	0	.0	.10945836 02 .103 00	-.0393*	.49344051 02 .104 00	-.1230*
235702	0	0	.0	.10953896 02 .103 00	-.0172*	.49570349 02 .104 00	-.1455*
235802	0	0	.0	.10961915 02 .103 00	-.0249*	.49796696 02 .104 00	-.1641*
235902	0	0	.0	.10969894 02 .103 00	-.0326*	.50023087 02 .104 00	-.1445*
				62/10/19			
000002	0	0	.0	.10977833 02 .103 00	-.0202*	.50249561 02 .104 00	-.0791*
000102	0	0	.0	.10985732 02 .103 00	-.0298*	.50476039 02 .104 00	-.0776*
000202	0	0	.0	.10993593 02 .103 00	-.0294*	.50702560 02 .104 00	-.1023*
000302	0	0	.0	.11001413 02 .103 00	-.0350*	.50929124 02 .104 00	-.0950*
000402	0	0	.0	.11009194 02 .103 00	-.0425*	.51155727 02 .104 00	-.0876*
000602	0	0	.0	.11024639 02 .103 00	-.0314*	.51609060 02 .104 00	-.0952*
000702	0	0	.0	.11032304 02 .103 00	-.0348*	.51835786 02 .105 00	-.0862*
000802	0	0	.0	.11039929 02 .103 00	-.0341*	.52062553 02 .105 00	-.0930*
000902	0	0	.0	.11047519 02 .103 00	-.0414*	.52289358 02 .105 00	-.0881*
001002	0	0	.0	.11055069 02 .103 00	-.0287*	.52516200 02 .105 00	-.0730*
001102	0	0	.0	.11062579 02 .103 00	-.0359*	.52743080 02 .105 00	-.0940*
001202	0	0	.0	.11070054 02 .103 00	-.0331*	.52969997 02 .105 00	-.1030*
001302	0	0	.0	.11077491 02 .103 00	-.0283*	.53196950 02 .105 00	-.0923*
001402	0	0	.0	.11084889 02 .103 00	-.0354*	.53423940 02 .105 00	-.1013*
001502	0	0	.0	.11092251 02 .103 00	-.0305*	.53650966 02 .105 00	-.1104*
001602	0	0	.0	.11099576 02 .103 00	-.0195*	.53878025 02 .105 00	-.1177*
001702	0	0	.0	.11106864 02 .103 00	-.0266*	.54105119 02 .105 00	-.1050*
001802	0	0	.0	.11114116 02 .104 00	-.0334*	.54332245 02 .105 00	-.0842*
001902	0	0	.0	.11121329 02 .104 00	-.0104*	.54559404 02 .105 00	-.0874*
002002	0	0	.0	.11128507 02 .104 00	-.0173*	.54786599 02 .105 00	-.0947*
002102	0	0	.0	.11135648 02 .104 00	-.0321*	.55013823 02 .105 00	-.1082*
002202	0	0	.0	.11142753 02 .104 00	-.0389*	.55241080 02 .105 00	-.1074*
002302	0	0	.0	.11149822 02 .104 00	-.0058*	.55468363 02 .105 00	-.1169*
002402	0	0	.0	.11156855 02 .104 00	-.0125*	.55695680 02 .105 00	-.1045*

MARINER STATISTICS STATION 4 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
10/181	CC3	10/18-183926	10/18-232726	213	.218-01	.218-01	.481-03	.477-03

STATION NUMBER 5 62/10/18 ITERATION NUMBER 3 PASS NUMBER 10/182 PAGE 10

TIME	TC	Q	FRQ	DEC		HA		CC3	
233926	50	5	8379.6					.11501267 06 .187 00	-.0107
233951	50	5	8379.6	.10221262 02 .183 00	.0458	.29029433 03 .188 00	.0100		
234026	50	5	8379.6					.11499732 06 .187 00	-.0625
234051	50	5	8379.6	.10236224 02 .183 00	.0267	.29052548 03 .188 00	.0087		
234126	50	5	8379.6					.11498208 06 .187 00	.0166
234151	50	5	8379.6	.10251124 02 .183 00	.0076	.29075679 03 .188 00	.0052		
234226	50	5	8379.6					.11496695 06 .187 00	-.0117
234251	50	5	8379.6	.10265962 02 .183 00	.0206	.29098826 03 .188 00	.0036		
234326	50	5	8379.6					.11495193 06 .187 00	-.0674
234351	50	5	8379.6	.10280737 02 .183 00	.0056	.29121988 03 .188 00	-.0021		
234426	50	5	8379.6					.11493701 06 .187 00	.0107
234451	50	5	8379.6	.10295451 02 .183 00	.0167	.29145164 03 .188 00	.0040		
234526	50	5	8379.6					.11492220 06 .187 00	.1221
234551	50	5	8379.6	.10310105 02 .183 00	.0258	.29168355 03 .187 00	.0080		
234626	50	5	8379.6					.11490749 06 .187 00	-.0518
234651	50	5	8379.6	.10324699 02 .183 00	.0110	.29191560 03 .187 00	.0017		
234726	50	5	8379.6					.11489289 06 .187 00	-.0313
234751	50	5	8379.6	.10339235 02 .183 00	.0163	.29214780 03 .187 00	.0054		
234926	50	5	8379.6					.11486400 06 .187 00	-.0029
234951	50	5	8379.6	.10368131 02 .183 00	.0091	.29261263 03 .187 00	.0023		
235026	50	5	8379.6					.11484971 06 .187 00	-.0361
235051	50	5	8379.6	.10382493 02 .183 00	.0325	.29284525 03 .186 00	.0096		
235126	50	5	8379.6					.11483553 06 .187 00	-.0313
235151	50	5	8379.6	.10396797 02 .183 00	.0180	.29307801 03 .186 00	.0067		
235226	50	5	8379.6					.11482145 06 .187 00	.0283
235251	50	5	8379.6	.10411045 02 .183 00	.0036	.29331091 03 .186 00	.0096		
235326	50	5	8379.6					.11480747 06 .187 00	.0264
235351	50	5	8379.6	.10425238 02 .183 00	.0251	.29354395 03 .186 00	.0125		
235426	50	5	8379.6					.11479360 06 .187 00	.0010
235451	50	5	8379.6	.10439374 02 .183 00	.0108	.29377712 03 .186 00	.0151		
235526	50	5	8379.6					.11477982 06 .187 00	-.0254
235551	50	5	8379.6	.10453457 02 .183 00	-.0034	.29401042 03 .186 00	.0137		
235626	50	5	8379.6					.11476615 06 .187 00	.0264
235651	50	5	8379.6	.10467486 02 .183 00	.0203	.29424385 03 .185 00	.0161		
235726	50	5	8379.6					.11475258 06 .187 00	.0156
235751	50	5	8379.6	.10481460 02 .183 00	.0062	.29447742 03 .185 00	.0184		
235826	50	5	8379.6					.11473911 06 .187 00	-.0547
235851	50	5	8379.6	.10495382 02 .183 00	.0161	.29471112 03 .185 00	.0146		
235926	50	5	8379.6					.11472574 06 .187 00	-.0059
235951	50	5	8379.5	.10509248 02 .183 00	.0020	.29494494 03 .185 00	.0146		
				62/10/19					
000026	50	5	8379.6					.11471248 06 .187 00	.0225
000051	50	5	8379.6	.10510894 02 .183 00	.0242	.29519925 03 .188 00	-.0058		
000126	50	5	8379.6					.11469931 06 .187 00	-.0088
000151	50	5	8379.6	.10524477 02 .183 00	.0104	.29543355 03 .188 00	-.0063		
000226	50	5	8379.6					.11468624 06 .187 00	-.0186
000251	50	5	8379.6	.10538009 02 .183 00	.0327	.29566799 03 .188 00	-.0069		
000326	50	5	8379.6					.11467327 06 .187 00	.0117
000351	50	5	8379.6	.10551489 02 .183 00	.0190	.29590254 03 .188 00	-.0036		
000426	50	5	8379.6					.11466039 06 .187 00	.0049
000451	50	5	8379.6	.10564921 02 .183 00	.0054	.29613721 03 .188 00	-.0064		
000526	50	5	8379.6					.11464762 06 .187 00	.0195

STATION NUMBER 5 62/10/19 ITERATION NUMBER 3 PASS NUMBER 10/182 PAGE 11

TIME	TC	Q	FRQ	DEC		HA		CC3	
000551	50	5	8379.6	.10578303 02 .183 00	.0159	.29637200 03 .188 00	-.0033		
000626	50	5	8379.6					.11463494 06 .187 00	-.0049
000651	50	5	8379.6	.10591635 02 .183 00	.0404	.29660691 03 .187 00	-.0043		
000726	50	5	8379.6					.11462236 06 .187 00	.0146
000751	50	5	8379.6	.10604917 02 .183 00	.0289	.29684193 03 .187 00	-.0075		
000826	50	5	8379.6					.11460988 06 .187 00	-.0234
000851	50	5	8379.6	.10618151 02 .183 00	.0135	.29707708 03 .187 00	-.0088		
000926	50	5	8379.6					.11459750 06 .187 00	.0029
000951	50	5	8379.6	.10631337 02 .183 00	.0161	.29731233 03 .187 00	-.0062		
001026	50	5	8379.6					.11458521 06 .187 00	-.0283
001051	50	5	8379.6	.10644474 02 .183 00	.0228	.29754771 03 .187 00	-.0097		
001126	50	5	8379.6					.11457301 06 .187 00	-.0146
001151	50	5	8379.6	.10657564 02 .183 00	.0096	.29778318 03 .187 00	-.0114		
001226	50	5	8379.6					.11456092 06 .187 00	-.0176
001251	50	5	8379.6	.10670608 02 .183 00	.0183	.29801878 03 .187 00	-.0111		
001326	50	5	8379.6					.11454891 06 .187 00	-.0146
001351	50	5	8379.6	.10683603 02 .183 00	.0231	.29825448 03 .187 00	-.0109		
001426	50	5	8379.6					.11453701 06 .187 00	.0322
001451	50	5	8379.6	.10696552 02 .183 00	.0100	.29849030 03 .187 00	-.0109		
001526	50	5	8379.6					.11452519 06 .187 00	-.0137
001551	50	5	8379.6	.10709454 02 .183 00	.0289	.29872622 03 .187 00	-.0089		
001626	50	5	8379.6					.11451347 06 .187 00	-.0146
001651	50	5	8379.6	.10722311 02 .183 00	.0159	.29896225 03 .186 00	-.0131		
001726	50	5	8379.6					.11450185 06 .187 00	-.0088
001751	50	5	8379.6	.10735122 02 .183 00	.0189	.29919839 03 .186 00	-.0094		
001826	50	5	8379.6					.11449032 06 .187 00	.0234
001851	50	5	8379.6	.10747886 02 .183 00	.0259	.29943463 03 .186 00	-.0118		
002026	50	5	8379.6					.11446753 06 .187 00	-.0098
002051	50	5	8379.6	.10773280 02 .183 00	.0242	.29990745 03 .186 00	-.0069		
002126	50	5	8379.6					.11445628 06 .187 00	.0244
002151	50	5	8379.6	.10785909 C2 .183 00	.0114	.30014401 03 .186 00	-.0076		
002226	50	5	8379.6					.11444511 06 .187 00	-.0332
002251	50	5	8379.6	.10798493 02 .183 00	.0387	.30038067 03 .186 00	-.0084		
002326	50	5	8379.6					.11443404 06 .188 00	-.0410
002351	50	5	8379.6	.10811036 02 .183 00	.0220	.30061744 03 .186 00	-.0073		
002426	50	5	8379.6					.11442306 06 .188 00	.0576
002451	50	5	8379.6	.10823531 02 .183 00	.0153	.30085431 03 .186 00	-.0063		
002526	50	5	8379.6					.11441217 06 .188 00	.0068
002551	50	5	8379.6	.10835984 02 .183 00	.C247	.30109128 03 .186 00	-.0055		
002626	50	5	8379.6					.11440137 06 .188 00	-.0146
002651	50	5	8379.6	.10848393 02 .183 00	.0321	.30132835 03 .186 00	-.0047		
002726	50	5	8379.6					.11439067 06 .188 00	-.0264
002751	50	5	8379.6	.10860759 02 .183 00	.0195	.30156552 03 .186 00	-.0060		
002826	50	5	8379.6					.11438005 06 .188 00	.0127
002851	50	5	8379.6	.10873082 C2 .183 00	.0311	.30180280 03 .186 00	-.0094		
002926	50	5	8379.6					.11436952 06 .188 00	.0010
002951	50	5	8379.6	.10885361 02 .183 00	.0186	.30204016 03 .186 00	-.0109		
003026	50	5	8379.6					.11435908 06 .188 00	.0615
003051	50	5	8379.6	.10897599 02 .183 00	.0361	.30227762 03 .186 00	-.0065		
003126	50	5	8379.6					.11434873 06 .188 00	.0127
003151	50	5	8379.6	.10909795 02 .183 00	.0238	.30251519 03 .185 00	-.0062		
003226	50	5	8379.6					.11433846 06 .188 00	-.0244
003251	50	5	8379.6	.10921946 02 .183 00	.C135	.30275284 03 .185 00	-.0041		
003326	50	5	8379.6					.11432829 06 .188 00	.0303

STATION NUMBER 5 62/10/19 ITERATION NUMBER 3 PASS NUMBER 10/182 PAGE 12

TIME	TC	Q	FRQ	DEC		HA		CC3	
003351	50	5	8379.6	.10934056 02 .183 00	.0272	.30299060 03 .185 00	-.0060		
003426	50	5	8379.6					.11431820 06 .188 00	.0371
003451	50	5	8379.6	.10946126 02 .183 00	.0150	.30322845 03 .185 00	-.0080		
003526	50	5	8379.6					.11430820 06 .188 00	.0166
003551	50	5	8379.6	.10958152 02 .183 00	.0508	.30346640 03 .185 00	-.0080		
003626	50	5	8379.6					.11429829 06 .188 00	.0293
003651	50	5	8379.6	.10970138 02 .183 00	.0167	.30370444 03 .185 00	-.0062		
003726	50	5	8379.6					.11428846 06 .188 00	.0146
003751	50	5	8379.6	.10982082 02 .183 00	.0266	.30394257 03 .185 00	-.0105		
003826	50	5	8379.6					.11427872 06 .188 00	-.0264
003851	50	5	8379.6	.10993984 02 .183 00	.0145	.30418079 03 .135 00	-.0069		
003926	50	5	8379.6					.11426907 06 .188 00	-.0117
003951	50	5	8379.6	.11005847 02 .183 00	.0265	.30441911 03 .185 00	-.0053		
004026	50	5	8379.6					.11425950 06 .188 00	.0156
004051	50	5	8379.6	.11017669 02 .183 00	.0145	.30465751 03 .185 00	-.0139		
004126	50	5	8379.6					.11425002 06 .188 00	.0576
004151	50	5	8379.6	.11029450 02 .183 00	.0405	.30489600 03 .185 00	-.0125		
004226	50	5	8379.6					.11424062 06 .188 00	-.0049
004251	50	5	8379.6	.11041191 02 .183 00	.0286	.30513459 03 .185 00	-.0092		
004326	50	5	8379.6					.11423131 06 .188 00	.0078
004351	50	5	8379.6	.11052892 02 .183 00	.0308	.30537327 03 .185 00	-.0101		
004426	50	5	8379.6					.11422208 06 .188 00	.0156
004451	50	5	8379.6	.11064552 02 .183 00	.0190	.30561203 03 .185 00	-.0090		
004526	50	5	8379.6					.11421294 06 .188 00	.0605
004551	50	5	8379.6	.11076174 02 .183 00	.0251	.30585088 03 .185 00	-.0080		
004626	50	5	8379.6					.11420388 06 .188 00	-.0400
004651	50	5	8379.6	.11087755 02 .183 00	.0134	.30608982 03 .185 00	-.0091		
004726	50	5	8379.6					.11419490 06 .188 00	.0176
004751	50	5	8379.6	.11099297 02 .183 00	.0297	.30632885 03 .185 00	-.0082		
004826	50	5	8379.6					.11418601 06 .188 00	.0117
004851	50	5	8379.6	.11110800 02 .183 00	.0181	.30656796 03 .185 00	-.0095		
004926	50	5	8379.6					.11417720 06 .188 00	.0635
004951	50	5	8379.6	.11122262 02 .183 00	.0065	.30680716 03 .185 00	-.0109		
005026	50	5	8379.6					.11416847 06 .188 00	.0313
005051	50	5	8379.6	.11133687 02 .183 00	.0328	.30704644 03 .185 00	-.0063		
005126	50	5	8379.6					.11415982 06 .188 00	-.0020
005151	50	5	8379.6	.11145074 02 .183 00	-.0007	.30728581 03 .185 00	-.0098		
005226	50	5	8379.6					.11415126 06 .188 00	.0039
005251	50	5	8379.6	.11156422 02 .183 00	.0258	.30752526 03 .185 00	-.0074		
005326	50	5	8379.6					.11414277 06 .188 00	-.0137
005351	50	5	8379.6	.11167730 02 .183 00	.0144	.30776480 03 .185 00	-.0071		
005426	50	5	8379.6					.11413437 06 .188 00	-.1113
005451	50	5	8379.6	.11179000 02 .183 00	.0229	.30800442 03 .184 00	-.0069		
005526	50	5	8379.6					.11412605 06 .188 00	-.0098
005551	50	5	8379.6	.11190233 02 .183 00	.0116	.30824412 03 .184 00	-.0067		
005626	50	5	8379.6					.11411781 06 .188 00	-.0078
005651	50	5	8379.6	.11201428 02 .183 00	.0282	.30848389 03 .184 00	-.0046		
005726	50	5	8379.6					.11410965 06 .188 00	.0127
005751	50	5	8379.6	.11212583 02 .183 00	.0169	.30872376 03 .184 00	-.0047		
005826	50	5	8379.6					.11410157 06 .188 00	-.0273
005851	50	5	8379.6	.11223702 02 .183 00	.0256	.30896370 03 .184 00	-.0027		
005926	50	5	8379.6					.11409356 06 .188 00	-.0254
005951	50	5	8379.6	.11234783 02 .183 00	.0144	.30920373 03 .184 00	-.0029		
010026	50	5	8379.6					.11408564 06 .188 00	-.0215

STATION NUMBER 5 62/10/19 ITERATION NUMBER 3 PASS NUMBER 10/182 PAGE 13

TIME	TC	Q	FRQ	DEC		HA		CC3	
010051	50	5	8379.6	.11245827 02 .183 00	.0392	.30944383 03 .184 00	.0008		
010126	50	5	8379.6					.11407780 06 .188 00	-.0186
010151	50	5	8379.6	.11256833 02 .183 00	.0021	.30968401 03 .184 00	-.0035		

MARINER STATISTICS STATION 5 ITERATION 3

PASS	DATA TYPE	BEGINNING TIME	END TIME	NUMBER OF POINTS	STD DEV	RMS	FIRST MOMENT	SECOND MOMENT
10/182	CC3	10/18-233926	10/19-010126	81	.331-01	.331-01	-.591-03	.109-02
	HA	10/18-183951	10/19-010151	81	.795-02	.868-02	-.348-02	.753-04
	DEC	10/18-183951	10/19-010151	81	.106-01	.229-01	.203-01	.525-03

ITERATION 3 GENERATED 16 PLOTS.

OFFLINE CCNTRCL (27
KEY(5)
END DATA (00

INPUT COVARIANCE MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.14764372-01	.12133066-01	.32046576-01	.34204017-04	.18074241-04	.81292810-04	.20391675 00	-.27649536-02	.11288408-02
Y	.12133066-01	.37882355 00	.69408379 00	.62127899-03	.40216185-03	.88521368-03	.15001394 01	-.39016967-01	-.11485511-02
Z	.32046576-01	.69408379 00	.14102823 01	.13862572-02	.80495197-03	.20125665-02	.27768874 01	-.74956287-01	.31840237-02
DX	.34204017-04	.62127899-03	.13862572-02	.14821648-05	.77838174-06	.21499007-05	.26652212-02	-.67547600-04	.77406520-05
DY	.18074241-04	.40216185-03	.80495197-03	.77838174-06	.46367414-06	.11422535-05	.15577744-02	-.41946636-04	.14039659-05
DZ	.81292810-04	.88521368-03	.20125665-02	.21499007-05	.11422535-05	.32694424-05	.36012987-02	-.10523597-03	.14375357-04
KE	.20391675 00	.15001394 01	.27768874 01	.26652212-02	.15577744-02	.36012987-02	.14693488 02	.43016005-01	.20345894-02
KM	-.27649536-02	-.39016967-01	-.74956287-01	-.67547600-04	-.41946636-04	-.10523597-03	.43016005-01	.24997383 02	-.37514658-04
RI04	.11288408-02	-.11485511-02	.31840237-02	.77406520-05	.14039659-05	.14375357-04	.20345894-02	-.37514658-04	.35888258-02
LA04	.64921410-05	-.95787267-04	-.10712261-03	-.45808345-07	-.49489806-07	.71638385-08	.11604473-03	-.18836405-05	-.38697642-06
LO04	.17821332-04	.20711727-03	.44092967-03	.38797852-06	.27904520-06	.74407486-06	-.15673334-03	.96496817-05	-.94684862-09
RI05	.14240673-02	.46162228-02	.13476359-01	.15716320-04	.76274993-05	.28133621-04	-.34468520-02	.52224820-04	.24265958-05
LA05	.24765557-04	.79823242-04	.23336013-03	.27221903-06	.13211916-06	.48779286-06	-.60260862-04	.78062734-06	.55369127-07
LO05	-.22069476-04	-.88286459-04	-.25443635-03	-.30110952-06	-.14157366-06	-.51455739-06	.54655159-04	-.79384651-05	.21584615-06

	LA04	LO04	RI05	LA05	LO05
X	.64921410-05	.17821332-04	.14240673-02	.24765557-04	-.22069476-04
Y	-.95787267-04	.20711727-03	.46162228-02	.79823242-04	-.88286459-04
Z	-.10712261-03	.44092967-03	.13476359-01	.23336013-03	-.25443635-03
DX	-.45808345-07	.38797852-06	.15716320-04	.27221903-06	-.30110952-06
DY	-.49489806-07	.27904520-06	.76274993-05	.13211916-06	-.14157366-06
DZ	.71638385-08	.74407486-06	.28133621-04	.48779286-06	-.51455739-06
KE	.11604473-03	-.15673334-03	-.34468520-02	-.60260862-04	.54655159-04
KM	-.18836405-05	.96496817-05	.52224820-04	.78062734-06	-.79384651-05
RI04	-.38697642-06	-.94684862-09	.24265958-05	.55369127-07	.21584615-06
LA04	.98208596-06	.31229541-08	.35150149-06	.65444070-08	.10230792-07
LO04	.31229541-08	.95988285-06	-.30097933-06	-.45436834-08	.35015982-07
RI05	.35150149-06	-.30097933-06	.35805436-02	-.33679265-06	-.96466709-07
LA05	.65444070-08	-.45436834-08	-.33679265-06	.99413668-06	-.25765525-08
LO05	.10230792-07	.35015982-07	-.96466709-07	-.25765525-08	.95812277-06

INPUT J MATRIX OF ESTIMATED PARAMETERS ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.54118917 02	-.72830780 02	.88354531 02	-.29061026 05	-.14223054 05	-.12823207 05	.00000000 00	.00000000 00	.00000000 00
Y	-.72830780 02	.26098586 03	-.25506021 03	.55915933 05	-.67048375 04	.53621163 05	-.00000000 00	-.00000000 00	-.00000000 00
Z	.88354531 02	-.25506021 03	.25803798 03	-.61470469 05	-.15768433 04	-.51339392 05	.00000000 00	.00000000 00	.00000000 00
DX	-.29061026 05	.55915933 05	-.61470469 05	.17347512 08	.49997007 07	.10624060 08	-.00000000 00	-.00000000 00	-.00000000 00
DY	-.14223054 05	-.67048375 04	-.15768433 04	.49997007 07	.79223018 07	-.24343293 07	.00000000 00	.00000000 00	.00000000 00
DZ	-.12823207 05	.53621163 05	-.51339392 05	.10624060 08	-.24343293 07	.11169038 08	-.00000000 00	-.00000000 00	-.00000000 00
KE	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.62500000-01	.00000000 00	.00000000 00
KM	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.39999999-01	.00000000 00
RI04	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.27777777 03
LA04	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO04	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI05	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA05	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO05	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	-.00000000 00	.00000000 00	.00000000 00	.00000000 00

	LA04	LO04	RI05	LA05	LO05
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00	-.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI04	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA04	.10000000 07	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO04	.00000000 00	.10000000 07	.00000000 00	.00000000 00	.00000000 00
RI05	.00000000 00	.00000000 00	.27777777 03	.00000000 00	.00000000 00
LA05	.00000000 00	.00000000 00	.00000000 00	.10000000 07	.00000000 00
LO05	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 07

```
CASE  1                                 SPACE TRAJECTORIES                                                      1

    EPHEMERIDES WITH VENUS VELOCITIES

  GME  .39860005 06     J  .16234500-02      H -.57499999-05      D  .78749999-05     RE  .63781650 04    REM  .63783149 04
    G  .66709998-19     A  .88745998 29      B  .88763998 29      C  .88800998 29    OME  .41780741-02     AU  .14959900 09
  GMM  .49007604 04   GMS  .13271544 12    GMV  .32476952 06    GMA  .42977799 05    GMB  .37918700 08    GMJ  .12671062 09
  ARA  .27890000 01    GB  .00000000 00    MAS  .34020000 03    GB1  .00000000 00    GB2  .00000000 00     SC  .00000000 00

INJECTICN CONDITIONS              MOON             JULIAN DATE 2437956.23429397               OCT. 18,1962    17 37 23.000

GEOCENTRIC       X0 .58072046 04  Y0-.18712696 04  Z0-.28917849 04 DX0 .36254794 01 DY0 .97646336 01 DZ0-.28587352 01
CARTESIAN       GMC .00000000 00 SGC .00000000 00  T0 .63443000 05 GHA .29107121 03 GH0 .26001651 02

  0 DAYS  0 HRS.  0 MIN.  0.000 SEC.               JULIAN DATE 2437956.23429397               OCT. 18,1962    17 37 23.000

GEOCENTRIC                                                                                      EQUATORIAL COORDINATES

    X  .58072044 04     Y -.18712696 04      Z -.28917849 04     DX  .36254793 01     DY  .97646332 01     DZ -.28587351 01
    R  .67518658 04   DEC -.25359354 02     RA  .34213937 03      V  .10801135 02    PTH  .87138015 01     AZ  .10292466 03
    R  .67518657 04   LAT -.25359354 02    LON  .51068163 02     VE  .10373187 02    PTE  .90762677 01    AZE  .10348129 03
   XS -.13520355 09    YS -.57485767 08     ZS -.24927463 08    DXS  .12999477 02    DYS -.24699600 02    DZS -.10709378 02
   XM -.35387369 05    YM  .35420195 06     ZM  .13533407 06    DXM -.10263042 01    DYM -.47486982-01    DZM  .61074528-01
   XT -.35387369 05    YT  .35420195 06     ZT  .13533407 06    DXT -.10263042 01    DYT -.47486982-01    DZT  .61074528-01
   RS  .14901675 09    VS  .29895608 02     RM  .38082357 06     VM  .10292159 01     RT  .38082357 06     VT  .10292159 01
  GED -.25510281 02   ALT  .37762042 03    LOS  .27196299 03    RAS  .20303420 03    RAM  .95705333 02    LOM  .16463412 03
  DUT  .49007604 04    DT  .37500000 01     DR  .16363603 01    SHA  .53923427 04    DES -.96296881 01    DEM  .20816250 02

GEOCENTRIC                                       CONIC        ORBITAL B.T AND B.R         EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE                JULIAN DATE 2437956.23211020               OCT. 18,1962    17 34 14.322
  SMA  .28338733 06   ECC  .97672778 00    INC  .28267556 02    LAN  .10032215 03    APF  .22709996 03    RCA  .65950506 04
   VH  .12868380 00    C3 -.14065556 01     C1  .72086041 05    SLR  .13036620 05    APO  .56017961 06    TFP  .18867777 03
   TA  .17636897 02    EA  .19287476 01     MA  .45241957-01    DAO -.20299315 02    RAO  .32378684 03    MTA  .18000000 03
   WX  .46592490 00    WY  .84859043-01     WZ  .88074566 00     PX  .75671527 00     PY -.55409865 00     PZ -.34692445 00
   QX  .45858031 00    QY  .82811443 00     QZ -.32238249 00     RX -.74409170-01     RY  .45422298 00     RZ -.88777512 00
  SXO  .75671527 00   SYO -.55409865 00    SZO -.34692445 00     TX -.64949612 00     TY -.69760743 00     TZ -.30248748 00
   BX -.45858034 00    BY -.82811448 00     BZ  .32238252 00     MX  .20775272 00     MY  .95707242 00     MZ -.20211671 00
  B.T  .47289870 05   B.R -.38184830 05      B  .60781685 05    PER  .25022493 05    OMD  .11568728-01    NOD -.70792969-02

HELIOCENTRIC                                                                                      ECLIPTIC COORDINATES

    X  .13520936 09     Y  .62654867 08      Z -.16775000 04     DX -.93739972 01     DY  .34742733 02     DZ -.65083369 01
    R  .14902081 09   LAT -.64496807-03    LON  .24862606 02      V  .36568945 02    PTH  .96058455 01     AZ  .10039908 03
   XE  .13520355 09    YE  .62657735 08     ZE  .23125000 03    DXE -.12999477 02    DYE  .26921386 02    DZE -.88334083-03
   XT  .13516816 09    YT  .63036539 08     ZT -.16518000 05    DXT -.14025781 02    DYT  .26902116 02    DZT  .74041843-01
  LTE  .88913821-04   LOE  .24864544 02    LTT -.63456084-02    LOT  .25002294 02    RST  .14914435 09    VST  .30338949 02
  EPS  .52998810 02   ESP  .27453512-18    SEP  .12699911 03    EPM  .59788076 02    EMP  .87784645 00    MEP  .11933403 03
  MPS  .10868797 03   MSP  .13970734 00    SMP  .71172218 02    SEM  .10950789 03    EMS  .70354204 02    ESM  .13776809 00
  EPT  .59788076 02   ETP  .87784645 00    TEP  .11933403 03    TPS  .10868797 03    TSP  .13970734 00    STP  .71172218 02
  SET  .10950789 03   STE  .70354204 02    EST  .13776809 00    RPM  .38417641 06    RPT  .38417641 06    SPN -.17845035 02
  SAC  .00000000 00
  GCE  .26321723 03   GCT  .28628363 03    SIP  .10842877 03    CPT  .73767243 02    SIN  .73508037 02
  REP  .67518658 04   VEP  .10801135 02
```

CASE 1 — SPACE TRAJECTORIES — 2

HELIOCENTRIC — CONIC — ORBITAL B.T AND B.R — ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE — JULIAN DATE 2437933.91684064 — SEPT. 26,1962 10 00 15.031

SMA	.29899028 09	ECC	.52194708 00	INC	.10399080 02	LAN	.20485908 03	APF	.15175261 03	RCA	.14293318 09
VH	.11807838 02	C3	-.44387877 03	C1	.53731260 10	SLR	.21753673 09	APO	.45504738 09	TFP	.19282280 07
TA	.28250957 02	EA	.16056168 02	MA	.77849552 01	DAI	.49006684 01	RAI	.35700551 03	MTA	.18000000 03
WX	-.75881468-01	WY	.16377873 00	WZ	.98357437 00	PX	.99498378 00	PY	-.52048824-01	PZ	.85428537-01
QX	.65185274-01	QY	.98512298 00	QZ	-.15900764 00	RX	.85310560-01	RY	-.44882075-02	RZ	-.99634422 00
SXI	.99498378 00	SYI	-.52048824-01	SZI	.85428537-01	TX	-.52241974-01	TY	-.99863447 00	TZ	.25379257-04
BX	-.65185279-01	BY	-.98512307 00	BZ	.15900765 00	MX	-.41353951 00	MY	.89241447 00	MZ	-.18050338 00
B.T	.25176442 09	B.R	-.40694425 08	B	.25503207 09	PER	.10320269 04	DEF			

SELENOCENTRIC — EQUATORIAL COORDINATES

X	.41194573 05	Y	-.35607322 06	Z	-.13822585 06	DX	.46517835 01	DY	.98121201 01	DZ	-.29198096 01
R	.38417641 06	DEC	-.21087782 02	RA	.27659928 03	V	.11244646 02	PTH	-.42143218 02	AZ	.13641074 03
R	.38417639 06	LAT	.29094274 01	LON	.88834020 01	VR	.10798765 02	PTR	-.44322086 02	AZR	.14623823 03
LTS	.15087128 01	LNS	.29766215 03	LTE	.32355818 01	LNE	.80671756 01				
ALT	.38243841 06	SHA	-.36362023 06	ALP	.74860422 00	DR	-.75450018 01	DP	.12434584-02	ASD	.25920568 00
HGE	.30700119 03	SVL	-.21786003 02	HNG	.24981456 03	SIA	.59528869 02				
SAC	.00000000 00										

2 DAYS 13 HRS. 46 MIN. 57.223 SEC. — JULIAN DATE 2437958.80856739 — OCT. 21,1962 07 24 20.223

GEOCENTRIC — EQUATORIAL COORDINATES

X	-.24434589 06	Y	.24844988 06	Z	.10730856 06	DX	-.68685615 00	DY	.50749150 00	DZ	.36028033 00
R	.36461950 06	DEC	.17115737 02	RA	.13452285 03	V	.92688775 00	PTH	.79759636 02	AZ	.54325788 02
R	.36461949 06	LAT	.17115737 02	LON	.35417584 03	VE	.25293702 02	PTE	.20666052 01	AZE	.27021782 03
XS	-.13217864 09	YS	-.62921468 08	ZS	-.27284285 08	DXS	.14196225 02	DYS	-.24167957 02	DZS	-.10478684 02
XM	-.24468582 06	YM	.28421080 06	ZM	.12522617 06	DXM	-.80652787 00	DYM	-.55468048 00	DZM	-.14564949 00
XT	-.24468582 06	YT	.28421080 06	ZT	.12522617 06	DXT	-.80652787 00	DYT	-.55468048 00	DZT	-.14564949 00
RS	.14891184 09	VS	.29923666 02	RM	.39538402 06	VM	.98963195 00	RT	.39538402 06	VT	.98963195 00
GED	.17225496 02	ALT	.35824316 06	LOS	.65109006 02	RAS	.20545601 03	RAM	.13072617 03	LOM	.35037917 03
DUT	.49007604 04	DT	.48000000 03	DR	.91212302 00	SHA	-.35275757 06	DES	-.10557630 02	DEM	.18464700 02

GEOCENTRIC — CONIC — ORBITAL B.T AND B.R — EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE — JULIAN DATE 2437956.30825638 — OCT. 18,1962 19 23 53.352

SMA	.30031613 06	ECC	.98480658 00	INC	.39070658 02	LAN	.11223143 03	APF	.21586105 03	RCA	.45628278 04
VH	.10079708 00	C3	-.13272682 01	C1	.60082059 05	SLR	.90563306 04	APO	.59606942 06	TFP	.21602687 06
TA	.17197484 03	EA	.10255766 03	MA	.47482229 02	DAO	-.21668192 02	RAO	.32153230 03	MTA	.18000000 03
WX	.58342578 00	WY	.23846507 00	WZ	.77636928 00	PX	.72763332 00	PY	-.57811613 00	PZ	-.36923090 00
QX	.36078291 00	QY	.78033097 00	QZ	-.51080295 00	RX	-.79618123-01	RY	.46344991 00	RZ	-.88253900 00
SXO	.72763332 00	SYO	-.57811613 00	SZO	-.36923090 00	TX	-.68133009 00	TY	-.67156228 00	TZ	-.29119309 00
BX	-.36078284 00	BY	-.78033082 00	BZ	.51080286 00	MX	-.45883314 00	MY	-.69197949 00	MZ	.55734819 00
B.T	.32391765 05	B.R	-.40872208 05	B	.52151356 05	PER	.27297817 05	OMD	.15372429-01	NOD	-.11853213-01

CASE 1 SPACE TRAJECTORIES 3

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13193429 09	Y	.68853016 08	Z	-.37750000 03	DX	-.14883082 02	DY	.26950781 02	DZ	.12761176 00
R	.14882001 09	LAT	-.14533768-03	LON	.27558862 02	V	.30787449 02	PTH	-.13500039 01	AZ	.89762449 02
XE	.13217864 09	YE	.68582384 08	ZE	.12750000 02	DXE	-.14196225 02	DYE	.26341848 02	DZE	-.10340214-02
XT	.13193395 09	YT	.68892954 08	ZT	.18345000 04	DXT	-.15002753 02	DYT	.25775008 02	DZT	.86008428-01
LTE	.49057291-05	LOE	.27423051 02	LIT	.70619714-03	LOT	.27572553 02	RST	.14883819 09	VST	.29823498 02
EPS	.10451898 03	ESP	.13525975 00	SEP	.75345207 02	EPM	.13830601 03	EMP	.37835540 02	MEP	.38584439 01
MPS	.11702639 03	MSP	.98911702-02	SMP	.62959891 02	SEM	.79190037 02	EMS	.10066046 03	ESM	.14935344 00
EPT	.13830601 03	ETP	.37835540 02	TEP	.38584439 01	TPS	.11702639 03	TSP	.98911702-02	STP	.62959891 02
SET	.79190037 02	STE	.10066046 03	EST	.14935344 00	RPM	.39999999 05	RPT	.39999999 05	SPN	.10351670 03
SAC	.00000000 00										
GCE	.10387919 03	GCT	.28025688 03	SIP	.11453610 03	CPT	.79419438 02	SIN	.76929153 02		
REP	.36461950 06	VEP	.92688775 00								

HELIOCENTRIC CONIC ORBITAL B.T AND B.R ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437980.06303136 NOV. 11,1962 13 30 45.910

SMA	.15880697 09	ECC	.67139447-01	INC	.23749126 00	LAN	.27593917 02	APF	.21857915 02	RCA	.14814476 09
VH	.27028610 02	C3	-.83570284 03	C1	.45805166 10	SLR	.15809112 09	APO	.16946919 09	TFP	-.18363857 07
TA	-.21892976 02	EA	-.20500478 02	MA	-.19153268 02	DAI	.88441556-01	RAI	.49451659 02	MTA	.18000000 03
WX	.19204445-02	WY	-.36744213-02	WZ	.99999141 00	PX	.65008836 00	PY	.75985665 00	PZ	.15435881-02
QX	-.75985578 00	QY	.65007981 00	QZ	.38479611-02	RX	-.10278369-02	RY	.11520607-02	RZ	-.99999849 00
SXI	.65008836 00	SYI	.75985665 00	SZI	.15435881-02	TX	.75985775 00	TY	-.65008938 00	TZ	.32067458-04
BX	.75985602 00	BY	-.65008000 00	BZ	-.38479622-02	MX	-.46265568 00	MY	.88652836 00	MZ	.41460189-02
B.T	.15844740 09	B.R	.61478574 06	B	.15844859 09	PER	.39949352 03	DEF			

SELENOCENTRIC EQUATORIAL COORDINATES

X	.33993359 03	Y	-.35760926 05	Z	-.17917604 05	DX	.11967172 00	DY	.10621720 01	DZ	.50592982 00
R	.39999999 05	DEC	-.26611602 02	RA	.27054462 03	V	.11825801 01	PTH	-.83602368 02	AZ	.10001899 03
R	.39999996 05	LAT	-.23400902 01	LON	.32916819 03	VR	.11757296 01	PTR	-.88305484 02	AZR	.13926691 03
LTS	.15301809 01	LNS	.26631341 03	LTE	-.40142985 00	LNE	.69670716 01				
ALT	.38261999 05	SHA	-.35627538 05	ALP	.16189759 01	DR	-.11752156 01	DP	.18874959-03	ASD	.24902844 01
HGE	.25548102 03	SVL	-.32263004 01	HNG	.11707280 03	SIA	.13581572 03				
SAC	.00000000 00										

2 DAYS 22 HRS. 16 MIN. 12.223 SEC. JULIAN DATE 2437959.16221322 OCT. 21,1962 15 53 35.223

GEOCENTRIC EQUATORIAL COORDINATES

X	-.26664170 06	Y	.26776289 06	Z	.12070285 06	DX	-.20208412 01	DY	.99816193 00	DZ	.87750500 00
R	.39669124 06	DEC	.17714493 02	RA	.13487979 03	V	.24187066 01	PTH	.71905386 02	AZ	.75600871 02
R	.39669123 06	LAT	.17714493 02	LON	.22687173 03	VE	.26926945 02	PTE	.48980191 01	AZE	.27039896 03
XS	-.13174237 09	YS	-.63658770 08	ZS	-.27603965 08	DXS	.14358929 02	DYS	-.24090877 02	DZS	-.10445269 02
XM	-.26856164 06	YM	.26641030 06	ZM	.12039731 06	DXM	-.75560138 00	DYM	-.60976630 00	DZM	-.17021993 00
XT	-.26856164 06	YT	.26641030 06	ZT	.12039731 06	DXT	-.75560138 00	DYT	-.60976630 00	DZT	-.17021993 00
RS	.14889752 09	VS	.29927459 02	RM	.39698276 06	VM	.98576022 00	RT	.39698276 06	VT	.98576022 00
GED	.17827595 02	ALT	.39031503 06	LOS	.29778207 03	RAS	.20579013 03	RAM	.13523041 03	LOM	.22722234 03
DUT	.49007604 04	DT	.15000000 02	DR	.22990893 01	SHA	-.38412221 06	DES	-.10683815 02	DEM	.17654770 02

CASE 1 SPACE TRAJECTORIES 4

GEOCENTRIC CONIC ORBITAL B.T AND B.R EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437957.42965858 OCT. 19,1962 22 18 42.502

SMA	-.10378810 06	ECC	.17738685 01	INC	.22681749 02	LAN	.85036772 02	APF	.30779080 03	RCA	.80318344 05
VH	.19597239 01	C3	.38405177 01	C1	.29800187 06	SLR	.22279253 06	APO	.00000000 00	TFP	.14969272 06
TA	.10430764 03	EA	.94968358 02	MA	.16194614 03	DAO	.21528134 02	RAO	.15574941 03	MTA	.12431481 03
WX	.38416634 00	WY	-.33361761-01	WZ	.92266097 00	PX	.77941747 00	PY	.54740047 00	PZ	-.30473133 00
QX	-.49489864 00	QY	.83620553 00	QZ	.23629556 00	RX	-.15937591 00	RY	.47657078 00	RZ	-.86456899 00
SXO	-.84815130 00	SYO	.38207474 00	SZO	.36695804 00	TX	.50521149 00	TY	.79176965 00	TZ	.34331064 00
BX	.36476786 00	BY	.92352902 00	BZ	-.11848444 00	MX	-.63293868 00	MY	-.73707163 00	MZ	.23688411 00
B.T	.13302947 06	B.R	.73663925 05	B	.15206319 06	PER	.00000000 00	OMD	.20218126-03	NOD	-.11456707-03

HELIOCENTRIC ECLIPTIC COORDINATES

X	.13147573 09	Y	.69679686 08	Z	.41962500 04	DX	-.16379770 02	DY	.27522707 02	DZ	.40694654 00
R	.14879894 09	LAT	.16157871-02	LON	.27922754 02	V	.32030639 02	PTH	-.28354181 01	AZ	.89271070 02
XE	.13174237 09	YE	.69386005 08	ZE	-.19000000 02	DXE	-.14358929 02	DYE	.26257836 02	DZE	-.10268688-02
XT	.13147381 09	YT	.69678323 08	ZT	.44540000 04	DXT	-.15114530 02	DYT	.25630682 02	DZT	.85388064-01
LTE	-.73112017-05	LOE	.27774855 02	LTT	.17150619-02	LOT	.27922636 02	RST	.14879661 09	VST	.29755472 02
EPS	.10431366 03	ESP	.14770671 00	SEP	.75538424 02	EPM	.96900760 02	EMP	.82759893 02	MEP	.33919698 00
MPS	.97049648 01	MSP	.27453512-18	SMP	.17029488 03	SEM	.75201185 02	EMS	.10465102 03	ESM	.14770671 00
EPT	.96900760 02	ETP	.82759893 02	TEP	.33919698 00	TPS	.97049648 01	TSP	.27453512-18	STP	.17029488 03
SET	.75201185 02	STE	.10465102 03	EST	.14770671 00	RPM	.23683385 04	RPT	.23683385 04	SPN	.10339242 03
SAC	.00000000 00										
GCE	.10316712 03	GCT	.14402448 03	SIP	-.37504977 02	CPT	.10109439 03	SIN	.53884444 02		
REP	.39669124 06	VEP	.24187066 01								

HELIOCENTRIC CONIC ORBITAL B.T AND B.R ECLIPTIC COORDINATES

EPOCH OF PERICENTER PASSAGE JULIAN DATE 2437978.72300189 NOV. 10,1962 05 21 07.363

SMA	.17511857 09	ECC	.15805265 00	INC	.72890430 00	LAN	.27795756 02	APF	.21201298 02	RCA	.14744062 09
VH	.23473234 02	C3	-.75786045 03	C1	.47602904 10	SLR	.17074400 09	APO	.20279652 09	TFP	-.16900521 07
TA	-.21074296 02	EA	-.18024538 02	MA	-.15222470 02	DAI	.26360944 00	RAI	.48995488 02	MTA	.18000000 03
WX	.59324982-02	WY	-.11254003-01	WZ	.99991908 00	PX	.65611123 00	PY	.75464968 00	PZ	.46008238-02
QX	-.75464039 00	QY	.65603083 00	QZ	.11860836-01	RX	.30427929-02	RY	.34510884-02	RZ	-.99998904 00
SXI	.65611123 00	SYI	.75464968 00	SZI	.46008238-02	TX	.75465786 00	TY	-.65611853 00	TZ	.31944951-04
BX	.75464068 00	BY	-.65603109 00	BZ	-.11860840-01	MX	-.46824320 00	MY	.88350804 00	MZ	.12721884-01
B.T	.17290515 09	B.R	.20564899 07	B	.17291738 09	PER	.46259795 03	DEF			

SELENOCENTRIC EQUATORIAL COORDINATES

X	.19199375 04	Y	.13525937 04	Z	.30554492 03	DX	-.12652398 01	DY	.16079282 01	DZ	.10477249 01
R	.23683385 04	DEC	.74125250 01	RA	.35164651 02	V	.22986936 01	PTH	.69272546 00	AZ	.62735868 02
R	.23683367 04	LAT	-.77884501 01	LON	.89452243 02	VR	.22925111 01	PTR	.69455766 00	AZR	.81749002 02
LTS	.15330163 01	LNS	.26200370 03	LTE	-.89932417 00	LNE	.66370633 01				
ALT	.63033853 03	SHA	.39924863 03	ALP	.14017789 03	DR	.27791341-01	DP	.55606837-01	ASD	.47209945 02
HGE	.25568633 03	SVL	-.63313428 01	HNC	.35262964 03	SIA	.49690816 02				
SAC	.00000000 00										

```
CASE  1                                        SPACE TRAJECTORIES                                           5

SELENOCENTRIC                                            CONIC         CRBITAL B.T AND B.R        EQUATORIAL COORDINATES

EPOCH OF PERICENTER PASSAGE                         JULIAN DATE 2437959.16197626            OCT. 21,1962    15 53 14.749
  SMA -.42785396 04   ECC  .15534725 01   INC  .28179120 02   LAN  .21110008 02   APF  .14716034 02   RCA  .23680540 04
   VH  .10702468 01    C3  .11454283 01    C1  .54436868 04   SLR  .60467608 04   APO  .00000000 00   TFP  .20473474 02
   TA  .11386407 01    EA  .53013366 00    MA  .29342867 00   DAI  .25261183 02   RAI  .82849387 02   MTA  .13006971 03
   WX  .17007809 00    WY -.44053855 00    WZ  .88147560 00    PX  .82164177 00    PY  .55723827 00    PZ  .11995985 00
   QX -.54403885 00    QY  .70385460 00    QZ  .45673888 00    RX -.61625215-01    RY  .43495366 00    RZ -.89834159 00
  SXO -.94523870 00   SYO  .17992809 00   SZO  .27230437 00   DAO  .15801435 02   RAO  .16922256 03    TF  .70264374 02
  SXI  .11257439 00   SYI  .89733799 00   SZI  .42674527 00    TX  .99173047 00    TY -.74831985-01    TZ -.10426329 00
   BX  .97897930 00    BY -.26651514-01    BZ -.20221088 00    MX -.88147560 00    MY -.27434253-11    MZ  .17007809 00
  B.T  .50556683 04   B.R  .55814143 03     B  .50863842 04   PER  .17609635 04   DEF  .17125124 00
 OP1   .00000000 00   OY   .00000000 00  OP2   .00000000 00
  BTE  .49576106 04   BRE  .11372781 04   BTO  .50556683 04   BRO  .55814143 03
  GP   .24662978 02   IR   .42299938 04   THA  .62998919 01
  ZAE  .13129025 03   ZAP  .12436705 03   ZAC  .78750643 02   ETE  .16899220 03   ETS  .35127208 03   ETC  .26503128 03
```

U MATRIX FOR MAPPING FORWARD ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	-.17652444 04	.15848604 04	.95200161 03	-.91048155 00	-.53057003 00	.56178070-01	.00000000 00	.00000000 00	.00000000 00
Y	.58012878 03	-.48095709 03	-.31224488 03	.30104389 00	.15852275 00	-.10900034-01	.00000000 00	.00000000 00	.00000000 00
Z	.88810600 03	-.82228722 03	-.51186704 03	.46401606 00	.27032801 00	-.10934090-01	.00000000 00	.00000000 00	.00000000 00
DX	-.84523905 06	.80392964 06	.47258491 06	-.43739980 03	-.26872724 03	.24538923 02	.00000000 00	.00000000 00	.00000000 00
DY	-.23062783 07	.20439737 07	.12555673 07	-.11934008 04	-.68014063 03	.60054422 02	.00000000 00	.00000000 00	.00000000 00
DZ	.66687538 06	-.61407503 06	-.36038497 06	.34335329 03	.20643462 03	-.23824786 02	.00000000 00	.00000000 00	.00000000 00
KE	.34039798 02	-.30607792 02	-.18592758 02	.17606430-01	.10201733-01	-.93245179-03	.10000000 01	.00000000 00	.00000000 00
KM	-.24238281 01	.25390625 01	.18300781 01	-.15201568-02	-.69713592-03	-.13363361-03	.00000000 00	.10000000 01	.00000000 00
RI04	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01
LA04	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO04	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI05	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA05	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO05	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00

	LA04	LO04	RIC5	LA05	LO05
X	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Y	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
Z	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DX	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DY	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
DZ	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KE	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
KM	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
RI04	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LA04	.10000000 01	.00000000 00	.00000000 00	.00000000 00	.00000000 00
LO04	.00000000 00	.10000000 01	.00000000 00	.00000000 00	.00000000 00
RI05	.00000000 00	.00000000 00	.10000000 01	.00000000 00	.00000000 00
LA05	.00000000 00	.00000000 00	.00000000 00	.10000000 01	.00000000 00
LO05	.00000000 00	.00000000 00	.00000000 00	.00000000 00	.10000000 01

CCVARIANCE MATRIX AT IMPACT ITERATION NUMBER 3

	X	Y	Z	DX	DY	DZ	KE	KM	RI04
X	.25760664 03	-.17865148 03	-.24373983 03	.16856791 00	.31217070-01	.68661883-01	.32747848 02	-.59793069 02	.44045273-01
Y	-.17865148 03	.20389116 03	.17465137 03	-.11788990 00	-.50999581-01	-.33915810-01	-.16115518 02	.62753750 02	-.74031388-01
Z	-.24373983 03	.17465137 03	.38933045 03	-.19179592 00	-.10339658-02	-.17138221 00	-.51212636 02	.46202296 02	.58198486-02
DX	.16856791 00	-.11788990 00	-.19179592 00	.11702219-03	.14507317-04	.66573452-04	.24801543-01	-.37780545-01	.14336361-04
DY	.31217070-01	-.50999581-01	-.10339658-02	.14507317-04	.20476750-04	-.17416160-04	-.21368627-02	-.17011449-01	.33065676-04
DZ	.68661883-01	-.33915810-01	-.17138221 00	.66573452-04	-.17416160-04	.93497355-04	.24187352-01	-.39604677-02	-.28999372-04
KE	.32747848 02	-.16115518 02	-.51212636 02	.24801543-01	-.21368627-02	.24187352-01	.14693488 02	.43016005-01	.20345894-02
KM	-.59793069 02	.62753750 02	.46202296 02	-.37780545-01	-.17011449-01	-.39604677-02	.43016005-01	.24997383 02	-.37514658-04
RI04	.44045273-01	-.74031388-01	.58198486-02	.14336361-04	.33065676-04	-.28999372-04	.20345894-02	-.37514658-04	.35888258-02
LA04	-.57703987-03	-.14940847-02	.23932497-02	-.85029826-06	.10467751-05	-.17947118-05	.11604473-03	-.18836405-05	-.38697642-06
LO04	-.35586000-03	-.37685689-02	-.49115349-02	.71571909-06	.51972728-06	.26183242-05	-.15673334-03	.96496817-05	-.94684862-09
RI05	-.98408259-01	.10007366-01	-.54399211-01	-.31628028-04	-.19376253-04	.58988831-04	-.34468520-02	.52224820-04	.24265958-05
LA05	-.17107875-02	.16740799-03	-.93716736-03	-.55198239-06	-.33254107-06	.10184520-05	-.60260862-04	.78062734-06	.55369127-07
LO05	.15258661-02	-.45517338-03	.11473544-02	.41193827-06	.47970107-06	-.11771757-05	.54655159-04	-.79384651-05	.21584615-06

	LA04	LO04	RI05	LA05	LO05
X	-.57703987-03	-.35586000-03	-.98408259-01	-.17107875-02	.15258661-02
Y	-.14940847-02	-.37685689-02	.10007366-01	.16740799-03	-.45517338-03
Z	.23932497-02	-.49115349-02	-.54399211-01	-.93716736-03	.11473544-02
DX	-.85029826-06	.71571909-06	-.31628028-04	-.55198239-06	.41193827-06
DY	.10467751-05	.51972728-06	-.19376253-04	-.33254107-06	.47970107-06
DZ	-.17947118-05	.26183242-05	.58988831-04	.10184520-05	-.11771757-05
KE	.11604473-03	-.15673334-03	-.34468520-02	-.60260862-04	.54655159-04
KM	-.18836405-05	.96496817-05	.52224820-04	.78062734-06	-.79384651-05
RI04	-.38697642-06	-.94684862-09	.24265958-05	.55369127-07	.21584615-06
LA04	.98208596-06	.31229541-08	.35150149-06	.65444070-08	.10230792-07
LO04	.31229541-08	.95988285-06	-.30097933-06	-.45436834-08	.35015982-07
RI05	.35150149-06	-.30097933-06	.35805436-02	-.33679265-06	-.96466709-07
LA05	.65444070-08	-.45436834-08	-.33679265-06	.99413668-06	-.25765525-08
LO05	.10230792-07	.35015982-07	-.96466709-07	-.25765525-08	.95812277-06

IMPACT PARAMETERS 62/10/21 155353

N MATRIX (TARGET ORBITAL PLANE)

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.13498505 04	-.22402019 01	.41325050-01	-.15793145-01	-.18645745 00	-.59219263-02
B.TO	-.22402077 01	.16038554 03	-.45120993-02	-.37801365-01	-.69219189-01	-.15618060-02
TL	.41325051-01	-.45121056-02	.39904870-05	-.30254727-05	-.78761252-05	-.50680620-06
C3	-.15793137-01	-.37801369-01	-.30254775-05	.17535673-04	.22095362-04	.11603023-05
S.TS	-.18645745 00	-.69219182-01	-.78761249-05	.22095361-04	.63648742-04	.19505274-05
S.RS	-.59219254-02	-.15618038-02	-.50680666-06	.11603017-05	.19505277-05	.10676296-06

NORMALIZED N MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
B.RO	.99999999 00	-.48146168-02	.56306379 00	-.10265133 00	-.63612429 00	-.49329858 00
B.TO	-.48146290-02	.10000000 01	-.17835410 00	-.71279338 00	-.68509214 00	-.37742805 00
TL	.56306382 00	-.17835435 00	.10000000 01	-.36167548 00	-.49420229 00	-.77645924 00
C3	-.10265127 00	-.71279345 00	-.36167606 00	.99999997 00	.66137077 00	.84800732 00
S.TS	-.63612430 00	-.68509209 00	-.49420226 00	.66137072 00	.10000000 01	.74825018 00
S.RS	-.49329849 00	-.37742751 00	-.77645994 00	.84800692 00	.74825029 00	.10000000 01

DM/DQO MATRIX

	B.RO	B.TO	TL	C3	S.TS	S.RS
X	.37860242 03	-.62915043 03	-.76171701 03	.11090058-01	.88300154 00	.92214173-02
Y	-.73392525 02	.23021360 03	.22165992 03	-.34133501-02	-.28989519 00	-.26028199-02
Z	-.14238562 03	.28774196 03	.41061202 03	-.57004266-02	-.44743651 00	-.52061935-02
DX	.19943532 06	-.26777504 06	-.40179114 06	.55533881 01	.42461314 03	.50394530 01
DY	.43053032 06	-.83235111 06	-.97959106 06	.14335638 02	.11545693 04	.11866120 02
DZ	-.16147645 06	.22848712 06	.29892461 06	-.43002419 01	-.33374950 03	-.36611142 01

B	.51182302 04
B.RO	.55679747 03
B.TO	.50878539 04
B.RT	.99525261 03
B.TT	.50205437 04
TL	.69771308 02
SMAA	.36740368 02
SMIA	.12664175 02
THETA	.89892090 02
DEL T	.71914333 01
DEL B	.38861755 02
DEL S	.76975188 01

N MATRIX (TARGET EQUATORIAL PLANE)

	B.RT	B.TT	TL
B.RT	.13405460 04	-.10481256 03	.40779151-01
B.TT	-.10481257 03	.16968991 03	-.80733845-02
TL	.40779152-01	-.80733910-02	.39904870-05

APPENDIX F

ODP format description

Sheet No. references are to Appendix E. All units are in kilometers and seconds unless otherwise specified.

Sheet No. 1	Control card input.
Sheet No. 2	Inverse of the *a priori* covariance matrix of estimated parameters.
Sheet No. 3–5	Trajectory based on initial injection conditions before any convergence on data is started. Its format is explained in Appendix D.
Sheet No. 6	The normal equation coefficients combined with the *a priori* matrix.
Sheet No. 7	See the next page of this Appendix for an explanation of the format.
Sheet No. 8	Covariance matrix of estimated parameters or inverse of Sheet No. 6.
Sheet No. 9	Correlation matrix of estimated parameters.
Sheet No. 10	Residual page for a particular station.

GMT	*TC*	Q	*FRQ*	*CC3* (HA or DEC)		
XX XX XX	X	X	XXXX.X	.XXXXXXXX XX	.XXX XX	.XXXX[h]
hr min sec	Doppler count time in sec.	Transmitting station	Last digits in transmitter frequency 2966 XXXX.X in cps.	Two-way doppler (CC3) value in cps, or hour angle in deg or declination in deg (floating point number)	Associated weight in floating point	Residual (observed minus calculated) in cps.

The sheet following the residuals has statistics on the previous residuals (self explanatory). The sheets following the statistics will have more residuals and statistics from other tracking stations. The sequence is then repeated for a few more iterations. On the last iteration a trajectory based on the converged estimated parameters is run out to lunar encounter (impact or closest approach). (See Appendix D.)

Following the trajectory printout is the U matrix which maps the covariance matrix at injection to encounter. Immediately below the U matrix is the covariance matrix on the estimated parameters at impact or closest approach epoch. This is formed by mapping the covariance matrix at injection to impact in double precision.

The sheet following the covariance matrix contains three blocks. The first block is a covariance matrix N formed by mapping the upper 6×6 matrix of the covariance of impact into a new coordinate system (explained in Appendix A of this Report) (σ_{TL}^2 is in hr^2). The second block is simply the correlation matrix of the first block covariance matrix. The third block is a mapping matrix which maps injection components into the **B**·**T**, **B**·**R**, etc. system.

B = The vector measured from the center of the Moon perpendicular to the incoming asymptote (in kilometers).

B·**RO** = The **B** vector dotted on the R axis in km (T axis in the Moon's orbital plane).

B·**TO** = The **B** vector dotted on the T axis in km (T axis in the Moon's orbital plane).

B·**RT** = The **B** vector dotted on the R axis in km (T axis in the equatorial plane of the Moon).

[h]Data have been deleted from the fit.

JOB TITLE

Iteration number   Epoch   year/month/day   XX XXX XX   Clock XXXXXX   SOS[h] XXXXX   QSOS[i] XXXXX

GMT				hr min sec	(PC time now) hr min sec	Floating pointing numbers
Q	***DQ***	**STDEVDQ**	**OLD Q**	**NEW Q**	**NOMINAL Q**	**DQ (NOM)**
X, Y, Z = Position space fixed cartesian component in km DX, DY, DZ = Velocity S.F.C. in km/sec RI = Radius in km KE = $GM_{\oplus}$ in km^3/sec^2 LA = Latitude in deg RE = Radius of Earth to scale ephemeris in km LO = Longitude in deg KM = $GM_{☾}$ in km^3/sec^2	Difference in estimated parameters from previous iteration and this iteration	Standard deviations on estimated parameters	Value of estimated parameters from previous iteration (Initial estimate on 1st iteration)	Value of estimated parameters on this iteration	Initial estimate of parameters	Total difference in new Q and nominal Q

[h] Weighted sum of the squares of the residuals.

[i] Weighted sum of the squares of the residuals plus the product $\delta x^T \Gamma^{-1} \delta x$ where δx is the difference in the *a priori* Q and the value of Q on the particular iteration and Γ is an *a priori* covariance on Q.

B·TT = The **B** vector dotted on the T axis in km (T axis in the equatorial plane of the Moon).

T_L = Linearized time of flight in hours.

SMAA = The largest eigenvalue of the upper 2×2 of the N matrix (commonly called the semimajor axis of a 40% dispersion ellipse in the B plane).

SMIA = The semiminor axis of the dispersion ellipse or the other eigenvalue of the upper 2×2.

THETA = The orientation angle of the semimajor axis of the dispersion ellipse measured counterclockwise from the T axis.

DEL T = Uncertainty in the time of flight in sec.

DEL B = $(N_{11} + N_{22})^{1/2}$ where N's are from the first block of this sheet.

DEL S = V_∞ (*DEL T*) The position uncertainty in the direction of the incoming asymptote. Where V_∞ = Hyperbolic excess velocity in km/sec.

ACKNOWLEDGMENT

The analysis presented in this Report represents the work of many people. Section VI illustrates the nearly complete dependence of the flight path analysis upon several complex digital computer programs. The steps in the development of such computing programs include the formulation of the physical and mathematical models of the processes, input and output requirements, programming and coding, checkout, continual modification and verification, and development and execution of in-flight operational procedures.

The development of the digital computer programs is a joint responsibility of the Systems Analysis Section (312) and the Computer Applications and Data Systems Section (372) at JPL. While these responsibilities often overlap, Section 372's responsibility includes programming and numerical analysis aspects, while Section 312's responsibility includes the physical models, specification of operational output, in-flight control, and overall coordination.

JPL's basic trajectory program has been developed almost completely by D. B. Holdridge of Section 372. His work includes the physical model as well as the programming. A. L. Laxdal has been very helpful in coordinating the trajectory with the ODP, in addition to developing the occultation package. Additional contributors are acknowledged in Ref. 7.

The ODP represents a new effort primarily by J. D. Anderson, Section 312, and R. H. Hudson, Section 372 (Ref. 11). This program

ACKNOWLEDGMENT (Cont'd)

allows for estimation of DSIF station locations and the major physical constants [i.e. $GM_{\oplus}$, $GM_{\leftmoon}$, radius of the Earth, J, D, H (Earth's harmonics), astronomical unit (AU), speed of light (C)]. T. W. Hamilton, of Section 312, provided continual guidance in its development.

The tracking data editing program represents the work of D. W. Trask (312) and R. E. Holzman (372).

The very broad interface with the DSIF has involved the Communications Engineering and Operations Section 332 and Section 312 in joint efforts, including the noise models, calibration of antennas, physical and mathematical models of the systems used, accuracy requirements, data format and condition coding, and prediction and acquisition information. Primary contributions in these areas have been made by J. P. Fearey, C. W. Johnson, W. Wollenhaupt, D. D. Meyer of Section 332 and D. L. Cain, M. S. Johnson, O. Asderian, J. Reuyl, and T. W. Hamilton of Section 312.

Additional contributions to the analysis and programming were made by various members of Sections 372, 312, and 332, D. L. Cain, C. T. Thornton, V. C. Clarke, W. L. Sjogren, D. W. Trask, H. Lass, C. B. Solloway, F. G. Curl, M. R. Warner, M. W. Nead, K. C. Oslund and C. D. Coltharp. The authors regret that the above list is not complete and extend their appreciation to all other contributors.